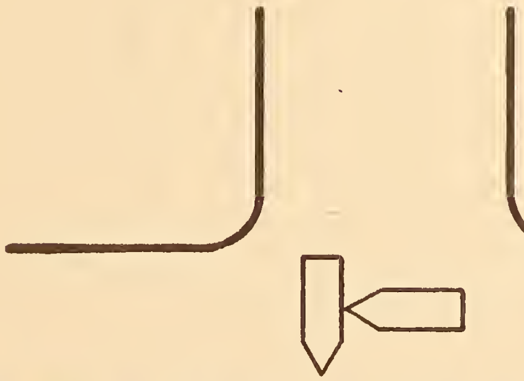
S Stahly Engineering
625.70428 Associates
M26Lchh Lake County high
1981 hazard location
study

LAKE COUNTY HIGH HAZARD LOCATION STUDY



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January 21, 1982

Lake County Commissioners
Lake County Courthouse
Polson, Mt. 59860

RE: Lake County High Hazard Location Study

Gentlemen:

Please find attached the final report of the Lake County High Hazard Location Study. This final report incorporates the review comments that were received from the Highway Traffic Safety Division.

All of the sites have recommended short term improvements, that consist mainly of signing. We have attempted not to oversign, these locations, but to only do that which is necessary to reduce the hazardousness of each location.

There were a total of 28 reported accidents recorded at the 11 sites studied during the 3-year period from 1977 thru 1979 for an average of 9.33 accidents per year. Based on the assumption that the traffic will increase five percent each year, it is estimated that these sites will experience approximately 36 reported accidents in the next five years if nothing is changed at these locations.

Existing documentation available to the Highway Safety Division indicates that the type of improvements recommended for short term improvements in this report normally reduce accidents rates by at least 50%. Based on the $7574 average economic loss per accident in Montana, the construction of the short term improvement would result in a total savings to the traveling public of over $136,000 during the next five years, this is more than eight times the $15,895 estimated cost to construct the short term improvements.

We wish to thank all of you for your efforts in reviewing the draft documents recently. We would also thank Les Shafer for his time, when each site was visited.

If you would have any further questions, please do not hesitate to contact us. We have enjoyed completing this project for Lake County.

Sincerely,

STAHLY ENGINEERING & ASSOCIATES

J. David Stahly, President

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INTRODUCTION

During the Fall of 1981, Lake County initiated a project to eliminate or alleviate existing problems at high hazard accident locations throughout the County. With technicial assistance from the Department of Justice, Highway Traffic Safety Division, ten original sites were selected for study. During a field review in November of 1981, an additional site was added, making a total of eleven sites.

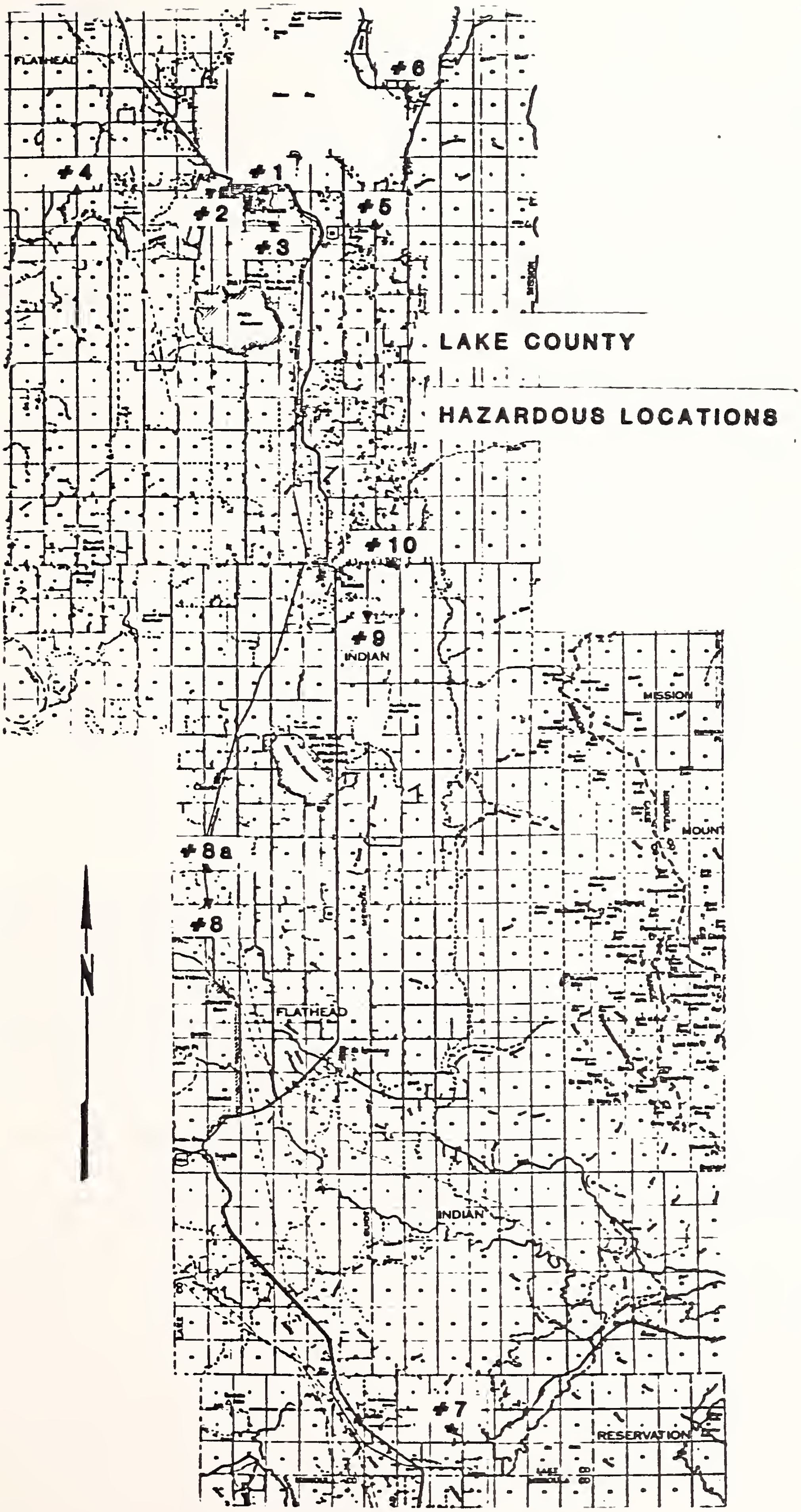
After interviewing various Consultants for developing the study, the Lake County Commissioners selected the firm of Stahly Engineering and Associates in association with Clete Daily and Associates.

The basic intent of the study is to analyze each site in relation to the degree of hazardness and establish a priority ranking for project improvements based on the composite hazard ranking and cost benefit ratios. The study will also present recommended improvements and provide a method for Lake County to continue the program in the future.

The locations of the various sites are shown on the Site Location Map, Figure 1. The sites are:

Site 1	Hillcrest Drive, Polson
Site 2	Kerr Dam Road, Polson
Site 3	Skyline Drive, Polson
Site 4	Irving Flats Road, West of Polson
Site 5	County Road and Turtle Lake Road
Site 6	Finley Point Road, East of Polson

Site 7	Theresa Adams Road, Southeast of Arlee
Site 8	County Road Northwest of St. Ignatius(4 mi W of 44 Bar on 93)
Site 8A	County Road,Northwest of St. Ignatius
Site 9	County Road Southeast of Ronan
Site 10	FAS 530, County Road East of Ronan


FLATHEAD
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LAKE COUNTY
HAZARDOUS LOCATIONS
#10
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INDIAN
MISSION
MOUNT
#8a
#8
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FLATHEAD
INDIAN
#7
RESERVATION

FIGURE 1

BASIC STUDY OUTLINE

The study is segregated into three phases which best achieve the purpose and scope of the study. These phases are:

Phase 1 - Data Collection

This phase includes the preliminary organization of the project including scheduling, form processing, field data collection and reduction of data. Accident data was obtained from reports filed at the Department of Justice. Traffic counts were taken at each location. The average daily traffic was determined by applying factors for seasonal and hourly variations.

Other data collected in the field included measurement of road widths and geometrics, an inventory of traffic control devices, turning movement counts and observation of traffic operations.

Phase 2 - Analysis of Data

This phase included the determination of hazard indices for each location by using the Federal Highway Administration Report No. FHWA-RD-77-83 " Identification of Hazardous Locations" and DCA Project No. 79-04-01-01 report. Computations involved with accidents, volumes, capacities, indicator values and other aspects of hazard indices were performed. From these computations a hazard ranking list was assembled.

Phase 3 - Evaluation of Corrective Measures and Priority Listing

This phase includes the determination of improvements that would reduce or eliminate certain types of hazards at the accident locations. Preliminary designs of those improvements include mostly signing and stripping. The improvements are based on short term improvements and in some cases long term improvement suggestions are given.

Cost effectiveness calculations of the improvements at each location are determined by preparing preliminary cost estimates and computing economic benefit to arrive at a cost-benefit ratio. The composite hazard index ranking and cost - benefit ratio determine the final priority listing.

HAZARD INDICES

Seven hazard indices are used as the basis of ranking hazardous sites, The following are brief descriptions of each index including data format, data collection and indicator scaling.

1. Number of Accidents - This indicator provides an historical background of accidents at the investigation site. In the case of Lake County, a three year period of 1977 to 1980 was used. Since all accident forms are filed with the Highway Patrol and the Montana Department of Highways Planning and Research Bureau, data is relatively accessable. Continuation of the program using this indicator will present little problem since the number of accidents can easily be updated periodically. The reader should be aware, that the number of accidents discussed at each site, are the number of reported accidents. There is a good possibility that many of the sites have had additional non-reported accidents.

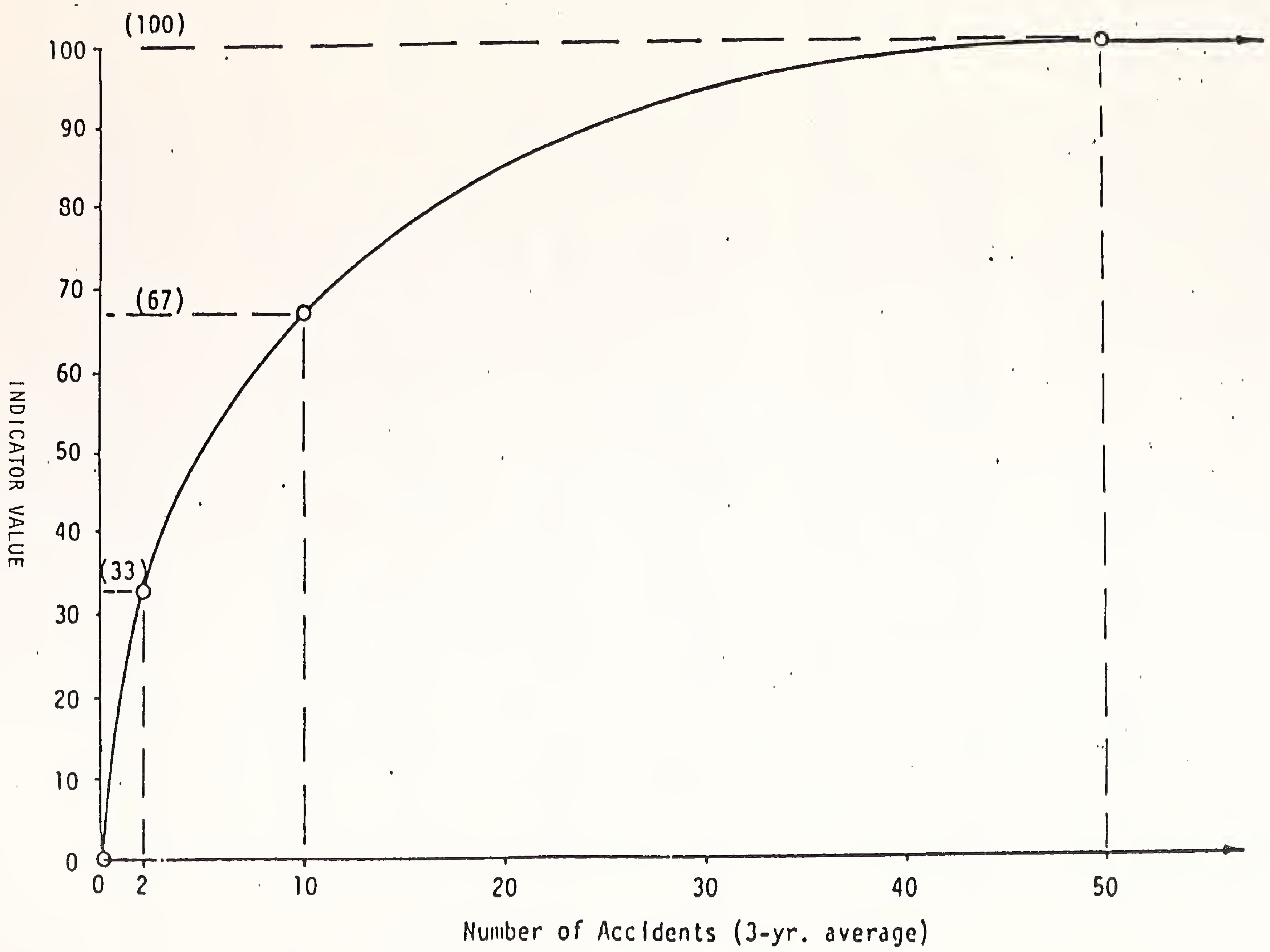


Figure 2. Indicator values for number of accidents.

Figure 2 is a curve extracted from FHWA Report No. FHWA-RD-77-83, which is used to determine this indicator value. The data base is number of accidents per year. This indicator, as all of the seven indicators used in the report, is scaled between 0 and 100. An average of two accidents per year in a three year period indicates a hazardous location, which is an indicator value of 33. Ten accidents on the average per year is used to designate very hazardous locations, which is an indicator value of 67.

2. Accident Rate Indicator - This indicator somewhat compensates for any incomplete information provided by the number of accident indicators in that an exposure value is provided by stating the relationship of accidents to the volumes of vehicles using the roadway or intersection.

The data base for this indicator is number of accidents per million entering vehicles. In the case of an intersection, million entering vehicles is the sum of the average daily approach volumes on all legs of the intersection, multiplied by the number of days in the analysis period. Although the accident rate indicator is a very important part of the hazard index ranking the data collection is possible only when a continued program of traffic counting has been performed. In lieu of a past counting program spot counts adjusted by yearly volume, increases, seasonal variations, daily variations, and hourly variations may be necessary to develop an average daily traffic figure applied to the analysis period.

Figure 3 represents the graphic plot of accident rate versus indicator value. As before, the indicator value ranges between 0 and 100.

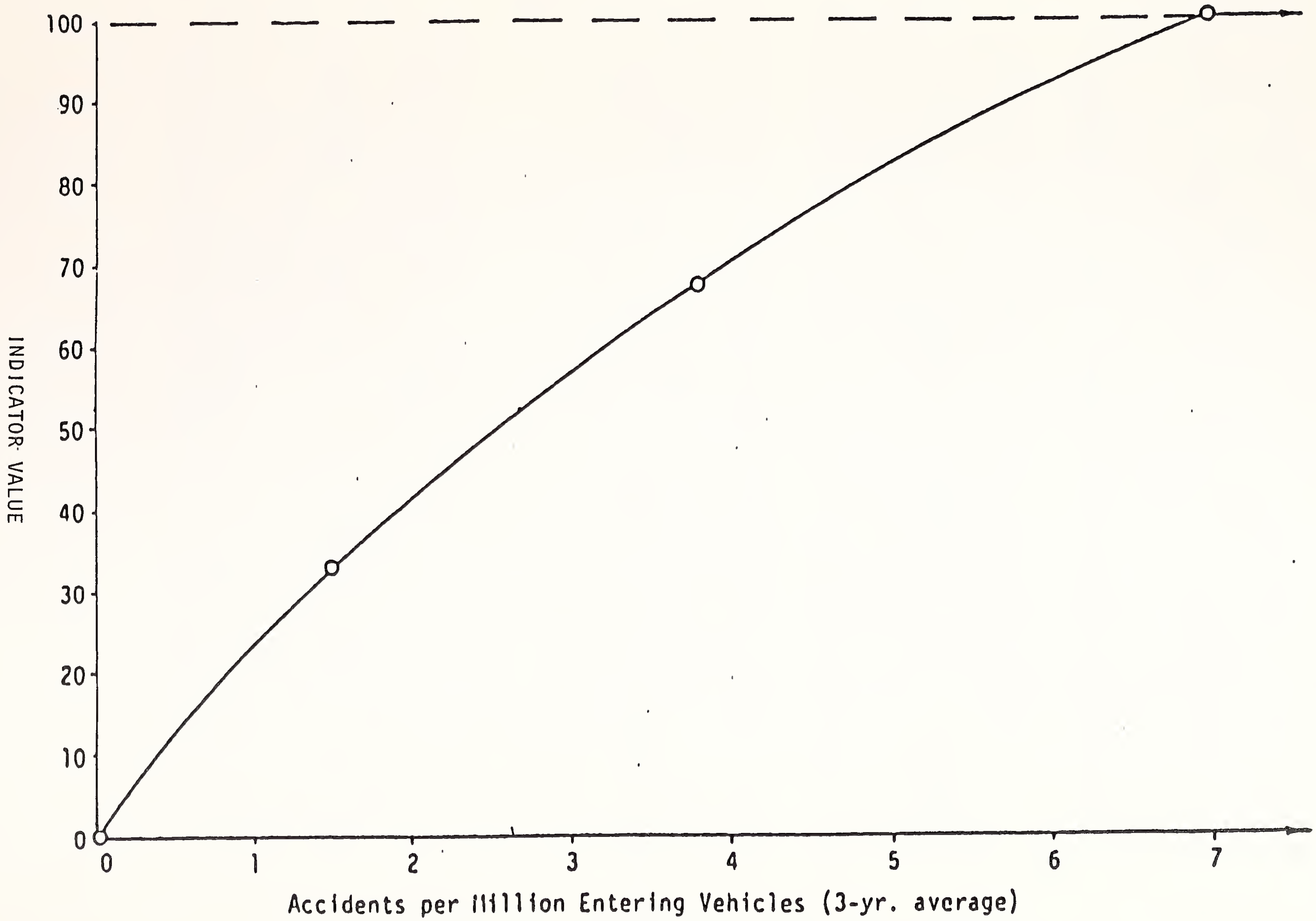


Figure 3. Indicator values for accident rate.

3. Accident Severity Indicator - Although there are many factors involved in the severity of accidents, statistical studies over a significant number of years have given fairly reliable dollar values in terms of economic loss for each type of accident. The accident severity indicator correlates a probable cause and effect relationship which aids in the determination of the level of accident reduction measures required. Severity values can also be used as a determinant of benefits resulting from various improvements.

The data base for accident severity is average relative severity in thousands of dollars. Data collection for the use of the severity index is convenient in that the type of accident relative to severity is coded on the accident report form, thus making the computation of accident severity relatively simple.

Table 1 presents the relative severity index values for each type of accident. Once the type of accident has been established, Figure 4 enables the user to access an indicator value. Figure 4 is a graphic plot of the average severity in thousands of dollars versus the indicator value which is based on a scale of 0 to 100.

4. Volume/Capacity Ratio Indicator - The Volume/Capacity Ratio Indicator incorporates the basic volume information for a location, and "normalizes" this data to compensate, to some extent, for the number of lanes, traffic mix, control devices, and turning directions. This enables all classes of road to be compared equally. The V/C Indicator does not rely on accident records. Estimates of hazardousness must be based totally on non-accident measures.

TABLE 1

RELATIVE SEVERITY INDEX

TYPE OF ACCIDENT	RSI	
	URBAN	RURAL
Multi-Vehicle, At Intersection		
Entering at angle	$ 4,300	$14,400
From same Direction -- both going straight	2,800	5,100
From same direction -- one turn, on straight	2,500	5,100
From same direction -- one stopped	3,800	5,200
From same direction - all others	2,000	6,300
From opposite direction -- both going straight	4,400	20,000
From opposite direction -- one left turn, on straight	4,400	15,400
From opposite direction -- all others	2,700	3,800
Not stated	3,800	5,200
Multi-Vehicle, Non-Intersection		
Going opposite direction -- both moving	$ 4,400	$19,600
Going same direction-- both moving	2,900	8,100
One car parked	1,600	2,400
One car stopped in traffic	4,200	6,800
One car entering parked position	1,900	2,300
One car leaving parked position	1,200	2,700
One car entering alley or driveway	3,400	6,000
One car leaving alley or driveway	2,000	4,400
All others	1,700	7,600
Not stated	3,400	6,000
Motor Vehicle with Pedestrian, At Intersection and Non-Intersection		
Vehicle going straight	$20,000	$49,000
Vehicle turning right	13,600	11,200
Vehicle turning left	17,100	11,200
Vehicle backing	20,600	11,200
All others	14,500	11,200
Not stated	11,200	11,200
Single Vehicle, at Intersection		
Collision with train	$26,700	$39,100
Collision with bicycle	13,100	31,900
Injury in vehicle, jacknifed	5,200	2,000
Collision with fixed object in road	5,500	7,000
Overturned in road	9,200	7,500
Left road	5,200	12,300
Single Vehicle, Non-Intersection		
Collision with train	$26,700	$39,100
Collision with bicycle	13,100	31,900
Injury in vehicle, jacknifed	5,200	2,000
Collision with fixed object in road	6,300	9,200
Overturned in road	10,000	9,400
Left road at curve	7,600	12,400
Left road on straight road	5,200	10,500
Other One Motor Vehicle, At Intersection and Non-Intersection		
Fell from moving vehicle	$15,000	$57,200
Collision with animal	4,800	1,800
Collision with other object	4,700	4,400
All others	5,200	2,000
Nont stated	3,200	3,400

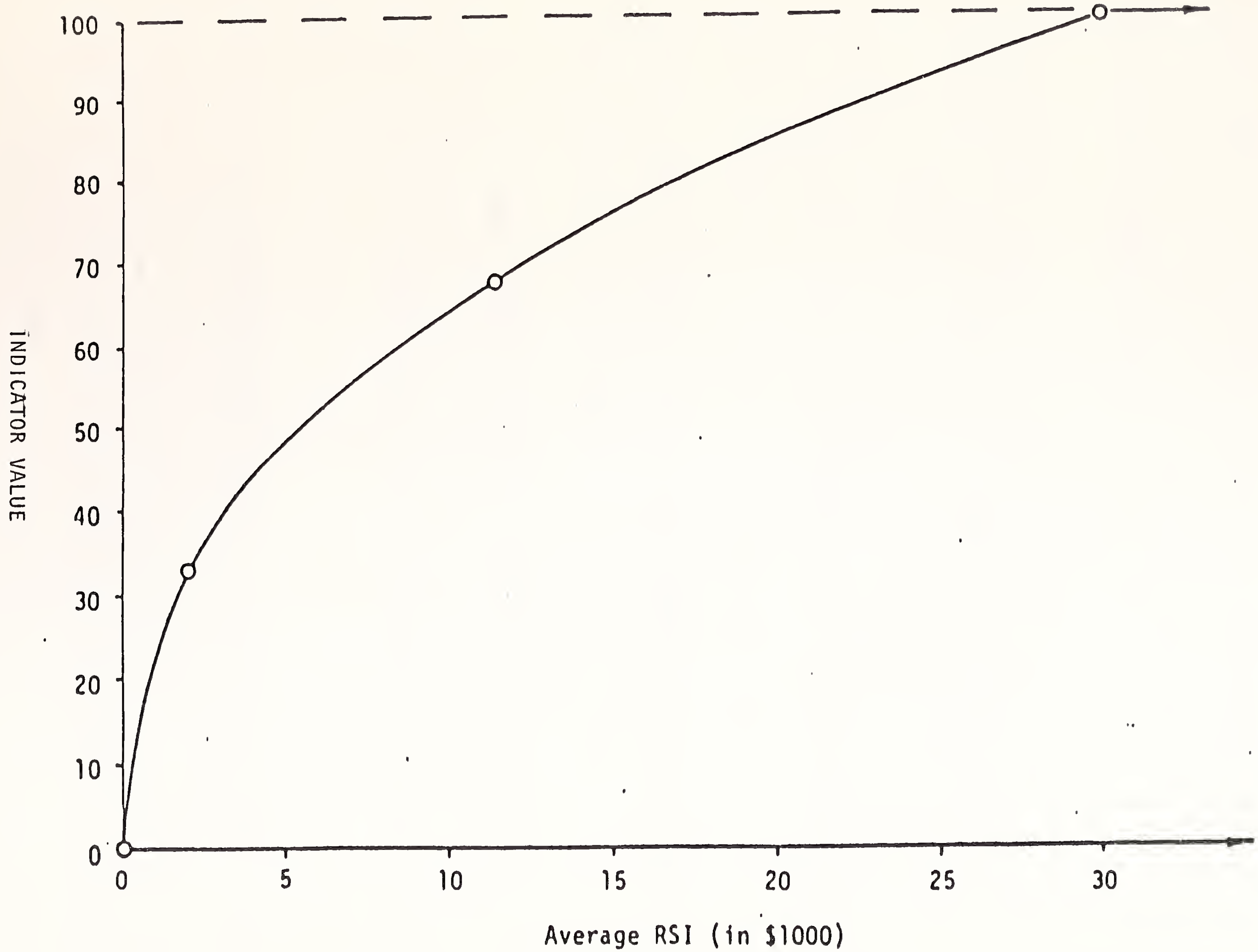


Figure 4. Indicator value for accident severity.

The Volume/Capacity Ratio as used in this study, takes the following form:

$$\frac{V}{C} = \frac{ADT}{24(\text{capacity})}$$

While this is not the standard expression for the volume/capacity ratio it does provide an idea of the average use of the facility throughout the day and gives emphasis to ADT.

The FHWA Report suggests that level of service C be used in determination of capacity. In this analysis, the capacity value usually obtained for an intersection must be doubled, since the two-way flow of traffic must be considered. The standard determinations of intersection capacity are based on one-way flows. Methodology presented in the Highway Capacity Manual - 1965, was used.

Figure 5 presents a graphic plot of the volume/capacity ratio versus the indicator value which is also scaled between 0 and 100.

5. Sight Distance Indicator - Sight distance is an obvious indicator of the hazardousness of a particular location. This indicator also does not rely totally on accident records but is a function of the roadway environment and geometry.

The data used to determine this indicator is the ratio of sight distance present to that specified as desirable in the appropriate AASHTO guides for the type of location involved. Actual sight distances were measured in the field in some cases. Table 2 presents the minimum stopping sight distance on wet pavement for various design speeds.

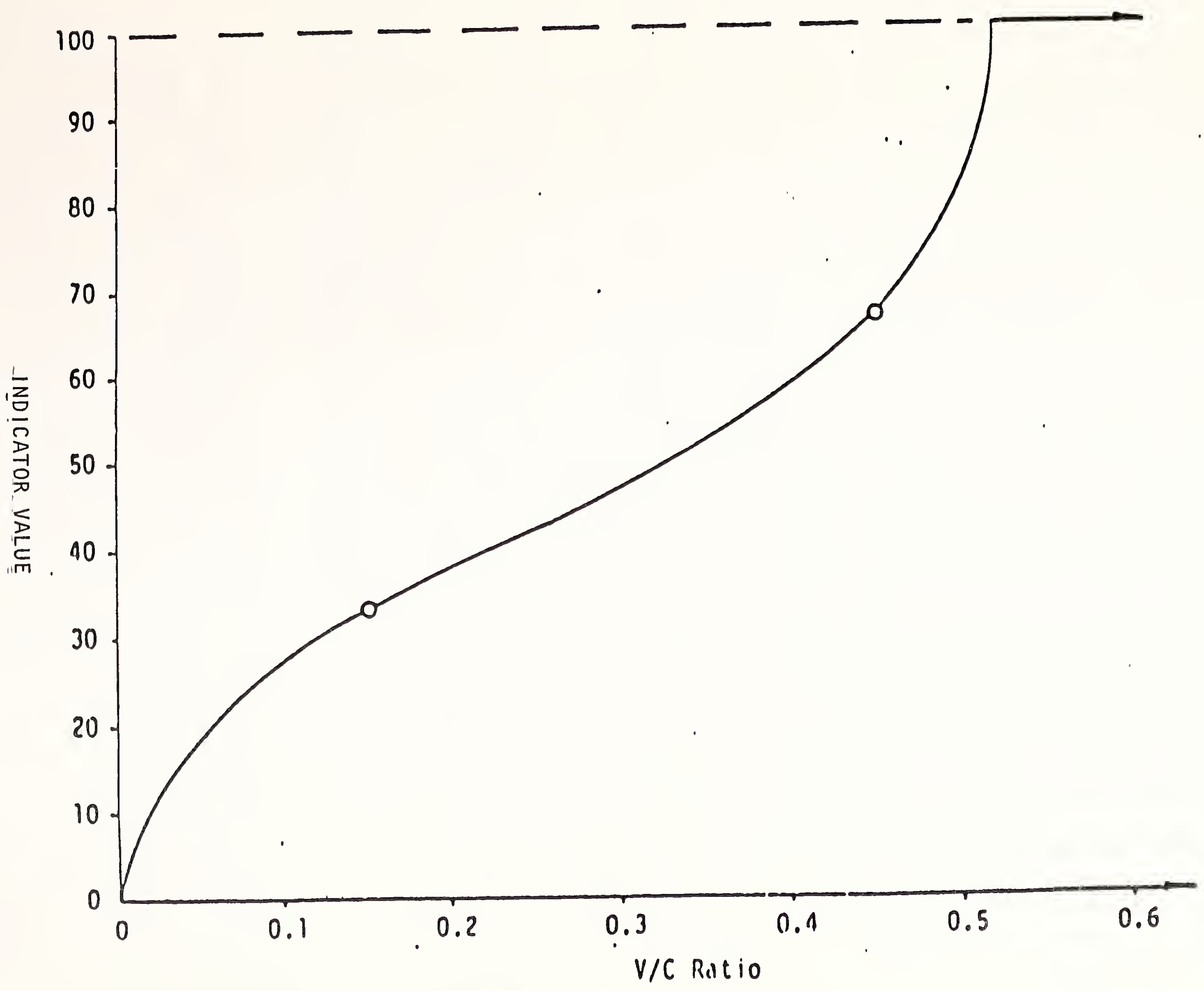


FIGURE 5 Indicator Values for V/C ratio

TABLE 2

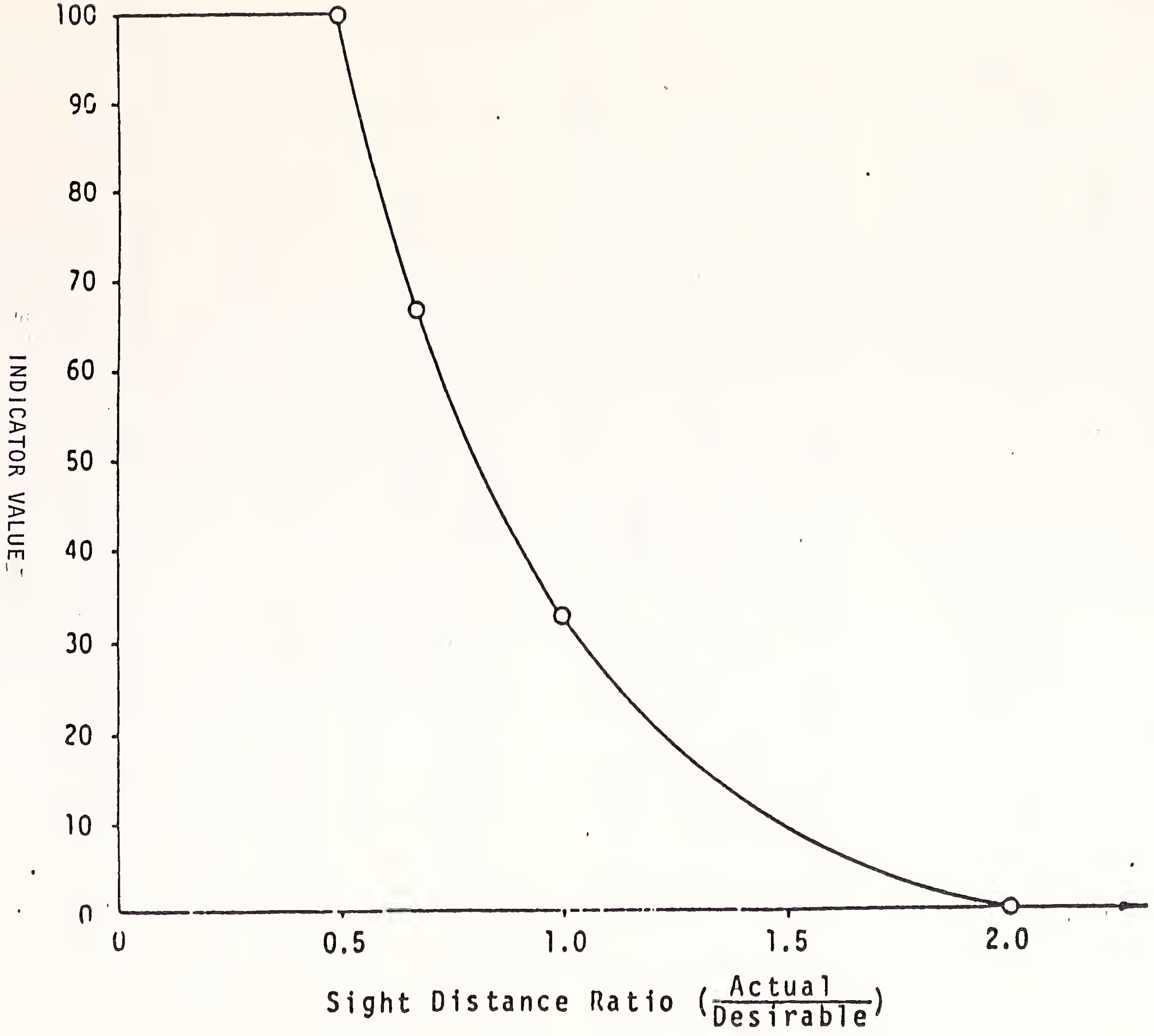
MINIMUM STOPPING SIGHT DISTANCE

(Wet Pavements)

DESIGN SPEED		STOPPING SIGHT DISTANCE	
mph	(kph)	Ft.	(m)
30	(48.3)	200	(61.0)
40	(64.4)	275	(83.8)
50	(80.4)	350	(106.7)
60	(96.5)	475	(144.8)
70	(112.6)	600	(182.9)

For a non-intersection location the minimum desireable sight distance is the safe stopping sight distance (SSSD) on approaches to the potential hazard. In the case of a signalized intersection or a four-way stop controlled intersection the distance from which the control device becomes visable on a given approach is the sight distance of interest. On two-way stop controlled intersections a minimum of four sight distances are critical - the distance at which the stop sign becomes visiable on each approach controlled by stop signs and the sight distance each way along the road to be crossed when the driver is stopped at the proper position on the most critical approach.

A Sight Distance Ratio Indicator must be determined for each approach to a hazardous location. However, a single Indicator Value must be determined for a particular location for use in the Hazard Index formula. To accomplish this, the FHWA report recommends that a weighted average of the two highest Indicator Values be used as the Indicator Value for that location. The highest Indicator Value would be weighted 2.0 and the next highest value weighted 1.0.



Sight Distance Ratio $\left(\frac{\text{Actual}}{\text{Desirable}}\right)$

Figure 6. Indicator values for sight distance.

Figure 6 shows the relationship between Sight Distance Ratio and Indicator Value.

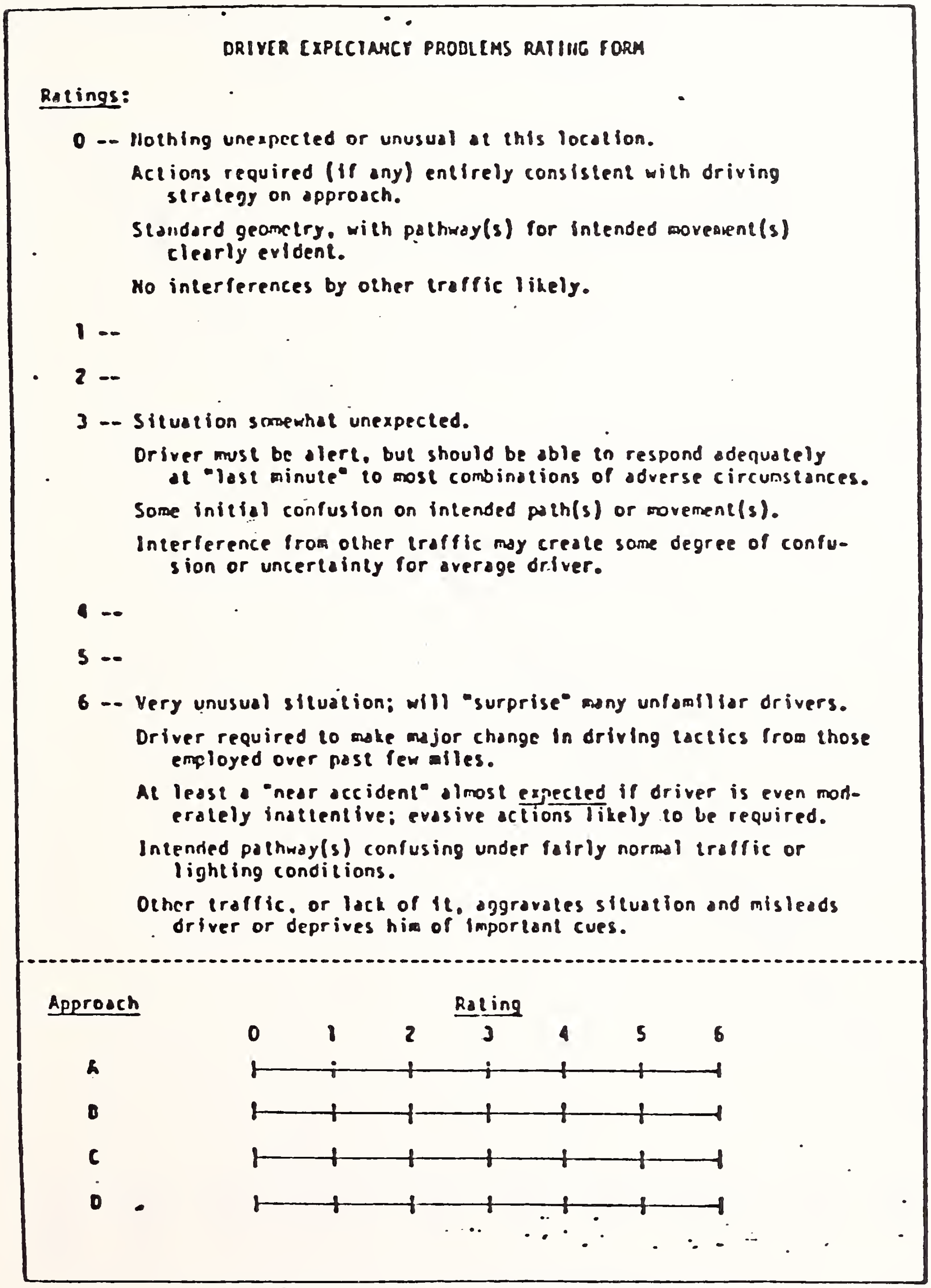
6. Driver Expectancy Indicator - Driver Expectancy relates to the readiness of the driver to respond to events, situations, or the presentation of information. It is a totally subjective parameter which attempts to deal with the drivers experience rather than an event on the roadway. For example, horizontal curves immediately beyond the crest of vertical curves or stop signs around horizontal curves are locations where driver expectancy contributes to the hazardousness of a location.

The data imput for this indicator is a Driver Expectancy Problems Rating for each approach to the site under consideration. A form for use in determining this rating is shown on Figure 7. Each site was visited by one or more individuals, and the average of the values assigned to each approach by each individual was used as the approach rating.

The form suggested for use in the FHWA report would rate each approach on a scale from 0 (excellent) through 6 (critical).

Figure 8 shows the relationship between Driver Expectancy Problems Rating and Indicator Value.

As with the Sight Distance Indicator, an Indicator Value is determined for each approach to a particular location. Then the weighted average of the two highest Indicator Values is determined and this Value is used as the Indicator Value for that location. Again, the highest Indicator Value is weighted 2.0 and the next highest Value is weighted 1.0.



DRIVER EXPECTANCY PROBLEMS RATING FORM

Ratings:

0 -- Nothing unexpected or unusual at this location.

Actions required (if any) entirely consistent with driving strategy on approach.

Standard geometry, with pathway(s) for intended movement(s) clearly evident.

No interferences by other traffic likely.

1 --

2 --

3 -- Situation somewhat unexpected.

Driver must be alert, but should be able to respond adequately at "last minute" to most combinations of adverse circumstances.

Some initial confusion on intended path(s) or movement(s).

Interference from other traffic may create some degree of confusion or uncertainty for average driver.

4 --

5 --

6 -- Very unusual situation; will "surprise" many unfamiliar drivers.

Driver required to make major change in driving tactics from those employed over past few miles.

At least a "near accident" almost expected if driver is even moderately inattentive; evasive actions likely to be required.

Intended pathway(s) confusing under fairly normal traffic or lighting conditions.

Other traffic, or lack of it, aggravates situation and misleads driver or deprives him of important cues.

Approach	Rating						
	0	1	2	3	4	5	6
A							
B							
C							
D							

Figure 7. Driver expectancy problems rating form.

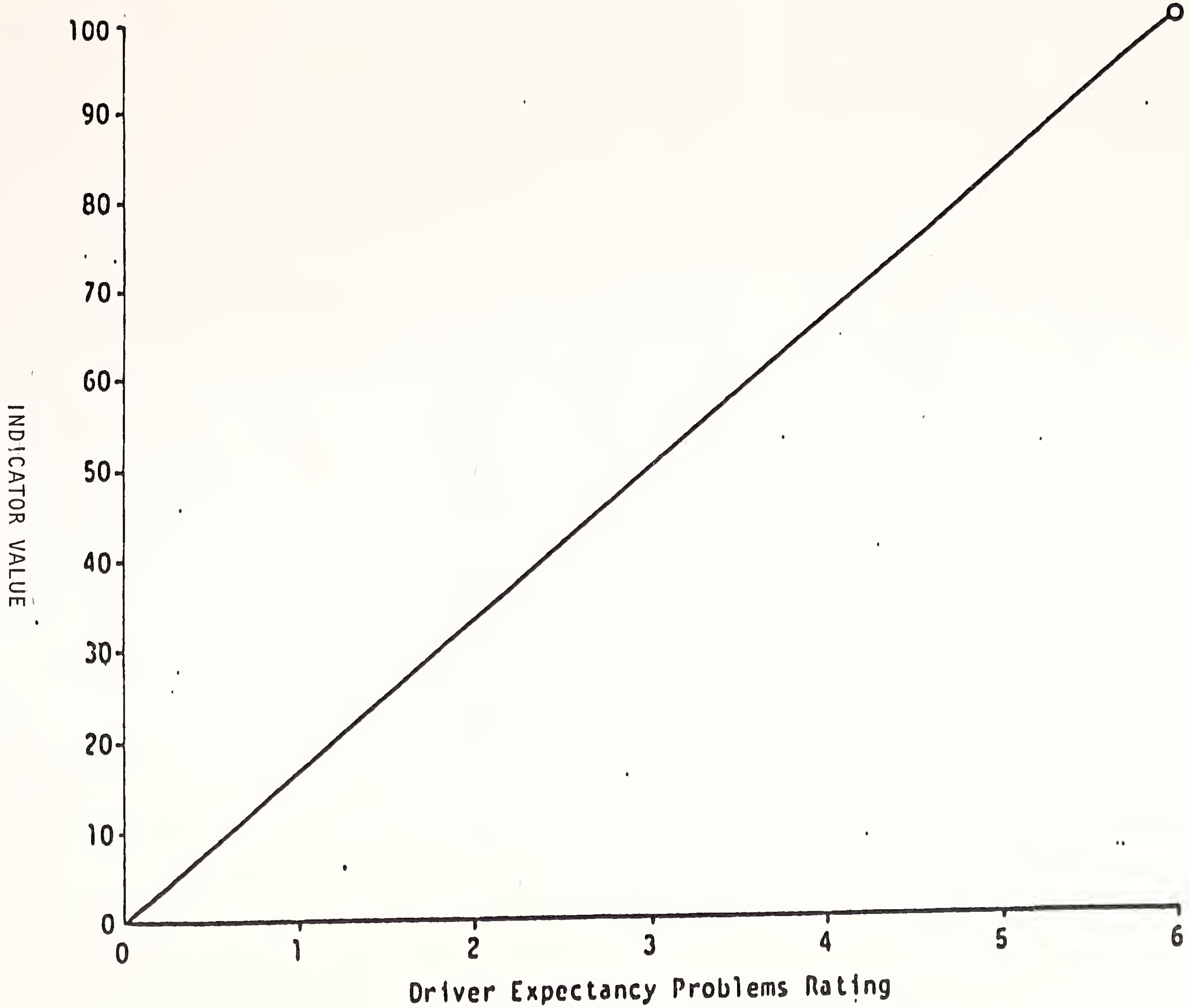
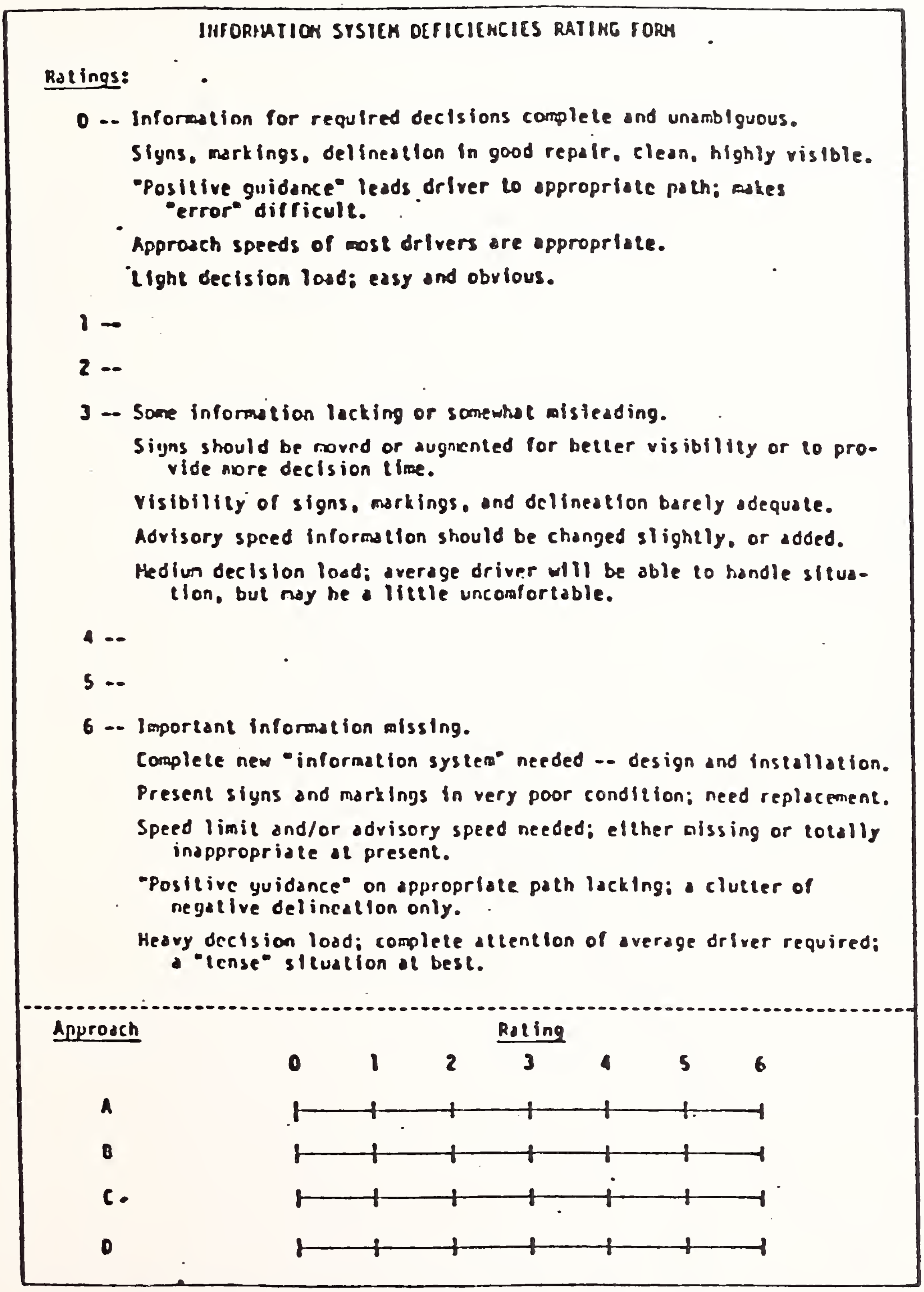


Figure 8. Indicator values for driver expectancy.

7. Information System Deficiencies Indicator - This is a subjective indicator of the adequacy of the systems at a location to enable the driver to make correct judgements and decisions. An inadequate information system creates a hazardous situation.

The data input for this indicator is an Information System Deficiencies Rating for each approach to the site under consideration. A form for use in determining this rating is shown on Figure 9. As with the Driver Expectancy Problems Rating, each approach was rated by one or more individuals and the average of this rating was used as the approach rating. The Information System Deficiencies Rating form provides for rating each approach on a scale from 0 (excellent) through 6 (critical).

The Indicator Values for Information System Deficiencies are again determined from a linear scale using the above limits as control values. Figure 10 shows the relationship between Information System Deficiencies Rating and Indicator Value. An Indicator Value is determined for each approach and the weighted average of the two highest values is used as the Indicator Value for that location again using weighting factors of 2.0 and 1.0 respectively.



INFORMATION SYSTEM DEFICIENCIES RATING FORM

Ratings:

0 -- Information for required decisions complete and unambiguous.

Signs, markings, delineation in good repair, clean, highly visible.

"Positive guidance" leads driver to appropriate path; makes "error" difficult.

Approach speeds of most drivers are appropriate.

Light decision load; easy and obvious.

1 --

2 --

3 -- Some information lacking or somewhat misleading.

Signs should be moved or augmented for better visibility or to provide more decision time.

Visibility of signs, markings, and delineation barely adequate.

Advisory speed information should be changed slightly, or added.

Medium decision load; average driver will be able to handle situation, but may be a little uncomfortable.

4 --

5 --

6 -- Important information missing.

Complete new "information system" needed -- design and installation.

Present signs and markings in very poor condition; need replacement.

Speed limit and/or advisory speed needed; either missing or totally inappropriate at present.

"Positive guidance" on appropriate path lacking; a clutter of negative delineation only.

Heavy decision load; complete attention of average driver required; a "tense" situation at best.

Approach	Rating 0	1	2	3	4	5	6
A							
B							
C							
D							

Figure 9. Information system deficiencies rating form.

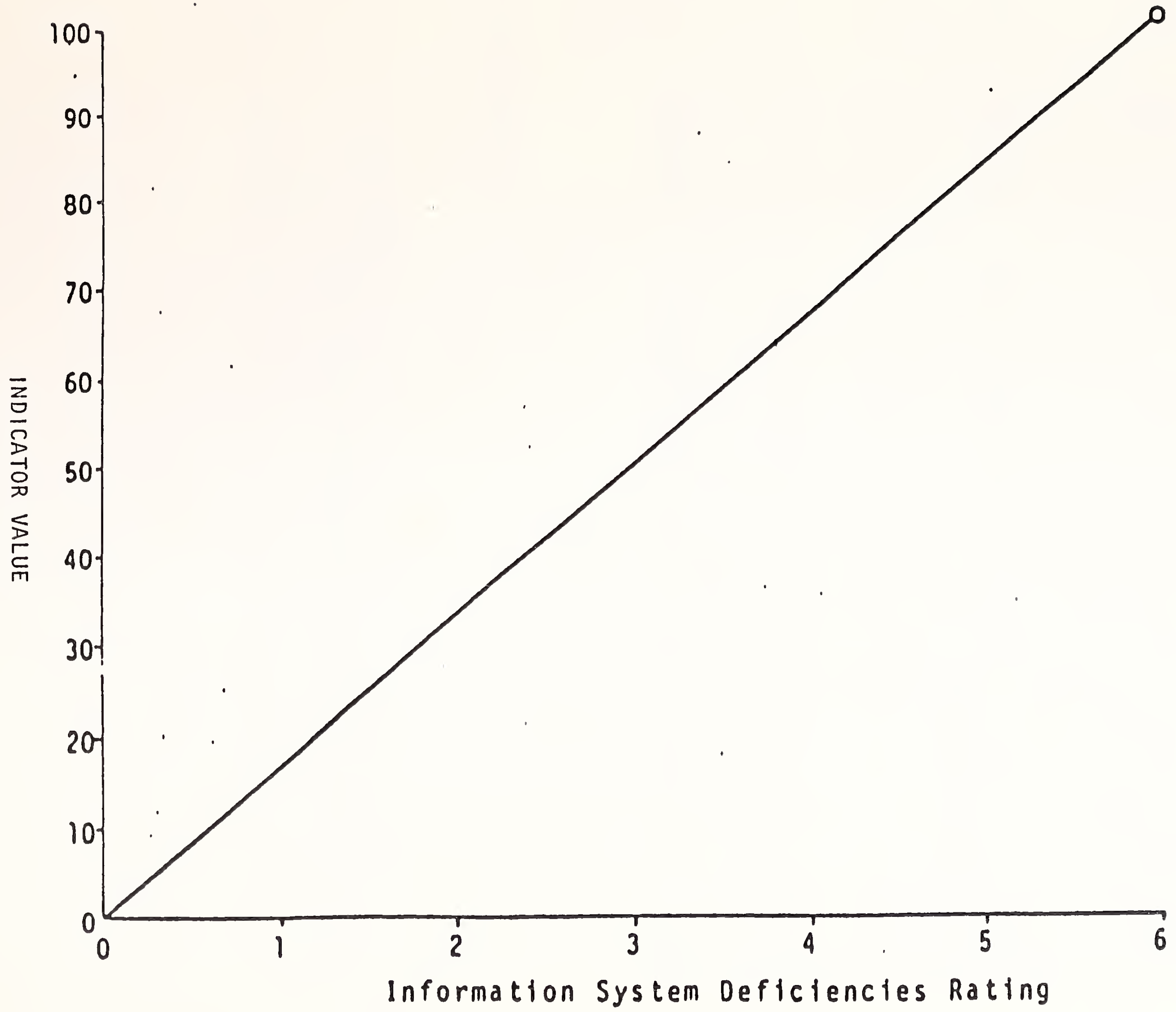


Figure 10. Indicator values for information system deficiencies.

HAZARD RANKING

Once all of the data has been collected to use in the computation of individual hazard index values and the indicator value has been computed, indicator values and necessary data is transferred to the Hazard Index Basic Computation Sheet. Separate sheets are included with each site analysis. Each indicator is weighted according to decisions based on the FHWA Report. The weighting factors are fractional portions of unity. When all nine indicators established in FHWA report are used the sum of weights is equal to one. In the case of Lake County, two indicators were omitted, the Traffic Conflict Indicator and the Erratic Maneuvers Indicators. They were omitted because their value of inclusion in the report was not felt to be any deterent in the ranking of hazardous sites. The use of seven indicators produces a strength of evaluation of confidence.

The results of the hazard index computation sheet are summarized in matrix form in order to arrive at a hazard index ranking. Ranked sites are listed in decreasing order of hazardness from 1 to 11. This information is shown on Table 3.

COST FACTOR (C.F.)

The costs are developed by preliminary estimation of required quantities based on current prices as tabulated from average bid prices of similar projects. The costs should not be considered a quote or final estimate of actual work.

TABLE 3

HAZARD INDEX RANKING

(7 Indicators - 88.6% Strength)

						INDICATOR VALUES				
RANK		SITE	NO. ACCIDENTS	ACCIDENT RATE	SEVERITY	VOL/CAP	SIGHT DISTANCE	DRIVER EXPECT.	INFO. DEFICIENT.	HAZARD INDEX
1.	#6	Finley Point Road	21	100	73	13	100	67	83	67.88
2.	#8	N.W. of St. Ignatius	28	100	72	21	100	56	61	65.32
3.	#7	S.E. of Arlee	12	100	66	12	100	56	72	62.08
4.	#2	Kerr Dam Road Curve	28	93	76	32	0	67	61	59.61
5.	#3	Sky Line Drive	21	100	77	15	90	22	50	57.56
6.	#5	County Road & Turtle Lake Road	21	72	67	11	100	67	50	56.48
7.	#9	S. E. of Ronan	12	100	62	17	57	33	67	54.53
8.	#4	West of Polson	2	100	62	3	0	33	50	45.53
9.	#10	East of Ronan	21	55	59	31	61	33	50	44.82
10.	#1	Hill Crest Drive and Fouty Driveway	2	34	46	30	61	61	61	39.87
11.	#8A	N.W. St. Ignatius	0	0	0	7	100	56	61	23.39
	Average Value		15.27	77.64	60.00	17.45	69.91	50.09	60.55	52.46
	Range		0-28	0-100	0-77	3-32	0-100	22-67	50-83	23.39 to 67.88

Even though Lake County maintenance crews are capable of performing the majority of the work, the costs are based on contract prices in order to correlate with costs requiring contract bid letting. The costs also do not include administrative, preliminary design details or field layout which occur in some short term improvements. The costs of the improvements for each site is shown in the cost estimate tables included in the discussions of each site.

A cost per vehicle was then determined by dividing the cost of the improvements by the total number of vehicles entering that location over a period of five years. A five year period was selected because this is a reasonable design life for a project involving new signing. If the recommended improvement for a location involves an alignment change or something other than signing, the design life would probably exceed five years. However, using an analysis period exceeding five years would tend to overemphasize those locations where signing improvements only are recommended.

A cost factor (C.F.) was developed for each location using the chart shown on Figure 11. The cost factor will be a value ranging from 10 (highest cost per vehicle) through 100 (lowest cost per vehicle). The relationship between cost per vehicle and cost factor will be linear. Any cost over $0.045/vehicle will have a cost factor of 10. It is felt that no project should be given a cost factor of zero. Table 4 summarize the cost and cost factors for each site.

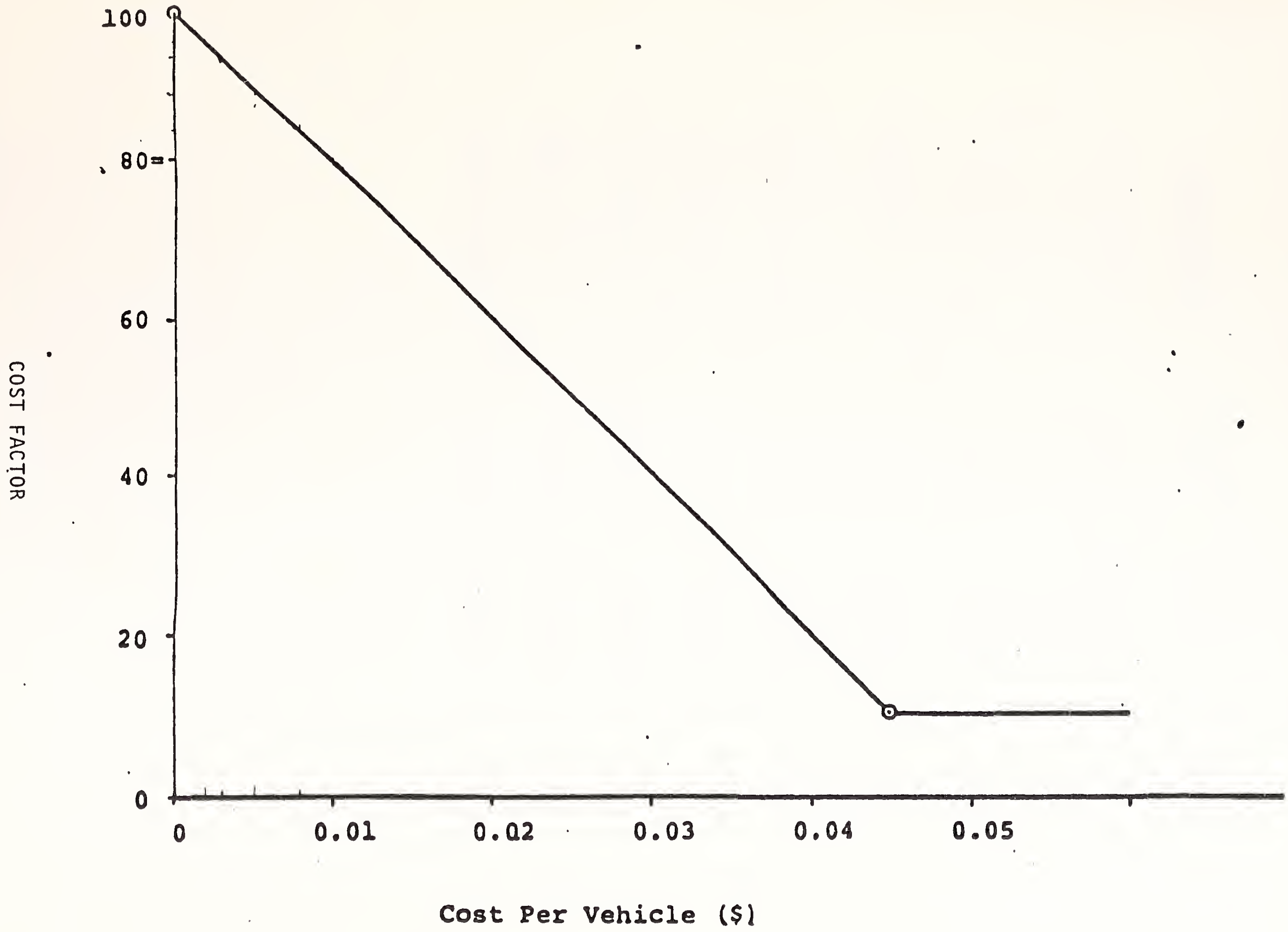


Figure 11. Form for determination of cost factor.

TABLE 4

SITE IMPROVEMENT COST AND COST FACTORS

ITE #	DESCRIPTION	IMPROVEMENT COSTS	No. VEHICLES FOR 5 YR. PERIOD	COST PER VEHICLE	COST FACTOR (Figure 11)
1.	Hillcrest Drive	520.00	1,040,250	$0.0005	99
2.	Kerr Dam Road	4,810.00	1,359,625	0.0035	93
3.	Skyline Drive	2,805.00	292,000	0.01	80
4.	Irving Flats Road	425.00	54,750	0.008	84
5.	County Road & Turtle Lake Road	975.00	602,250	0.002	96
6.	Finley Point Road	1,595.00	693,500	0.002	96
7.	Thersa Adams Road	850.00	164,250	0.005	89
8.	County Road N.W. of St. Ignatius	885.00	292,000	0.003	94
8A.	County Road N.W. of St. Ignatius	1,280.00	54,750.	0.023	53
9.	County Road S.E. of Ronan	790.00	401,500	0.002	96
10.	FAS 530, County Road East of Ronan	960.00	1,726,950	0.0006	99

PRIORITY INDEX (P.I.)

The final step in the evaluation of the hazardous locations is to develop a Priority Index (P.I.) for each location. The Priority Index is the weighted average of the Hazard Index and the Cost Factor. The Hazard Index is weighted 0.75 and the Cost Factor is weighted 0.25. The Priority Index formula will thus take the following form:

$$P.I. = 0.75\ (H.I.) \quad + \quad 0.25\ (C.F.)$$

Table 5 shows the computations for the priority index for each site. From this computation table, a final priority list is shown in Table 6.

IMPLEMENTATION

The priority lists have been arranged in a manner that budget considerations can readily be applied in the decision to proceed with improvements. The priority ranking should be the major consideration in selecting which sites will be receiving funds first. However, when limited funds are available it may be wise to do only partial projects, or skip over projects to keep within the budget.

As an example, Site #2, the curve on the Kerr Dam Road, and Site #3, Skyline Drive, both have a combination of signing and curve widening. If the budget would not allow the curve widening, but the signing, then the signing should be accomplished. This will help reduce the hazardousness of these locations.

TABLE 5

PRIORITY INDEX COMPUTATION

HAZARD INDEX RANK	HAZARD INDEX	COST FACTOR	PRIORITY INDEX 0.75 (H.I.) +0.25 (C.F.)	PRIORITY RANK	PRIORITY SITE
1	67.88	96	74.91	1	6
2	65.32	94	72.49	2	8
3	62.08	89	68.81	3	7
4	59.61	93	67.96	4	2
5	57.56	80	63.17	7	3
6	56.48	96	66.36	5	5
7	54.53	96	64.90	6	9
8	45.53	84	55.15	9	4
9	44.82	99	58.37	8	10
10	39.87	99	54.65	10	1
11	23.39	53	30.79	11	8A

TABLE 6

PRIORITY LIST

PRIORITY	SITE	PRIORITY INDEX	ESTIMATED COST
1	#6	74.91	1,595.00
2	#8	72.49	885.00
3	#7	68.81	850.00
4	#2	67.96	4,810.00
5	#5	66.36	975.00
6	#9	64.90	790.00
7	#3	63.17	2,805.00
8	#10	58.37	960.00
9	#4	55.15	425.00
10	#1	54.65	520.00
11	#8A	30.79	1,280.00
		Total Cost	$ 15,895.00

PROGRAM CONTINUATION

Since the basic format of the study has been outlined and an initial priority list established, continuance of the program is strongly advised. The findings and recommendations of this study will soon become obsolete without continued updating at least on an annual basis.

The indicators used in this evaluation permit the analysis of locations with completely different characteristics to be performed on an equal basis. Additional locations evaluated in the future can be compared with those locations already studied. Priorities can easily be adjusted as the Priority Index is not dependent of the number of locations studied. Also, cost estimates can be updated without reworking the entire Hazard Index. Therefore, the Priority Indexes can easily be up dated periodically.

The following recommendations in the continuance of the program are offered to Lake County:

1. The Highway Patrol and Sheriff's office should be assessed for copies of accident reports on a continuing basis.
2. One person should be assessed with the responsibility of the program to insure that all data is being supplied, processed and filed.
3. An accident cluster map should be maintained.
4. Develop criteria for the inclusion of additional sites to be analyzed.
5. Coordinate any traffic counting programs that may exist or establish a counting program.
6. Analyze new sites according to the procedures of this study and include them in the priority list when warranted.

SITE 1

SITE # 1

HILLCREST DRIVE

LOCATION AND EXISTING CONDITIONS

Site #1, Hillcrest Drive is located on the southeast edge of Polson, just outside the City Limits. It is just east of where Hillcrest Drive crosses the railroad tracks.

Hillcrest Drive has an asphalt surface twenty feet wide. The right of way width is 60 feet. Along the hazard section of the roadway, there are fairly substantial ditches on each side. This section of the roadway also has many driveways joining the roadway, along with a rolling terrain, which does create bad conditions when vehicles are traveling fairly fast.

Reference is made to the Existing Condition Sketch, Figure 1-1.

ACCIDENT ANALYSIS

During the three year period, there was one accident. This was an angle collision at a driveway; probably being caused by the restricted sight distance. Reference to Figure 1-2 for the collision diagram, followed by the Accident Summary.

The average accident severity at this location is $4400.00.

The average yearly number of accidents is 0.33 accidents per year and a yearly traffice volume of 0.208 million vehicles.

The accident rate calculates to be 1.59 accidents per million entering vehicles (MEV).

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&
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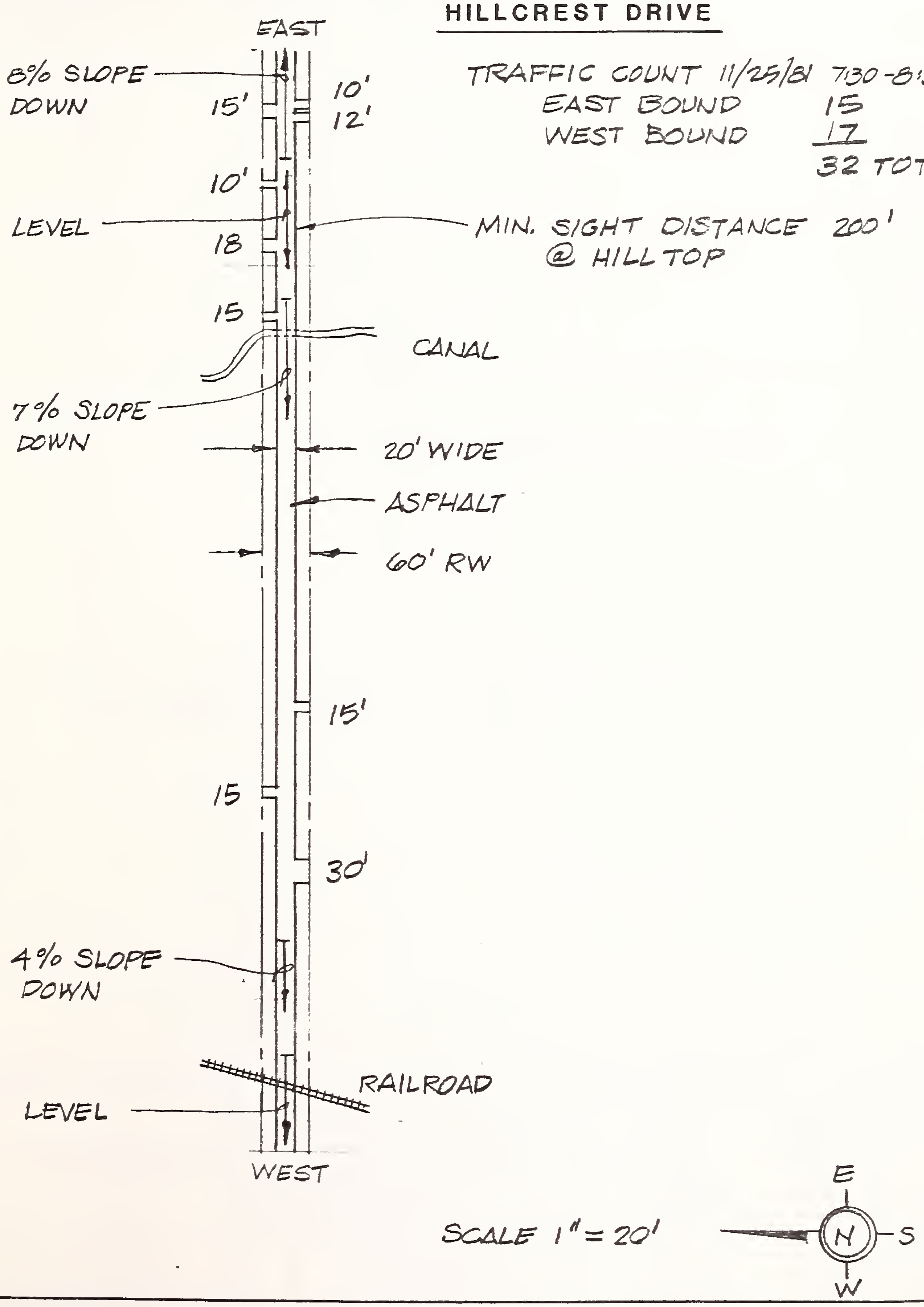
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ____ BY: ____
DATE ____ CK: ____
SITE #1

EXISTING CONDITION SKETCH

HILLCREST DRIVE

TRAFFIC COUNT 11/25/81 7:30-8:30 AM.
EAST BOUND 15
WEST BOUND 17
32 TOTAL



State Publishing Co Helena Mont

Figure 1-1

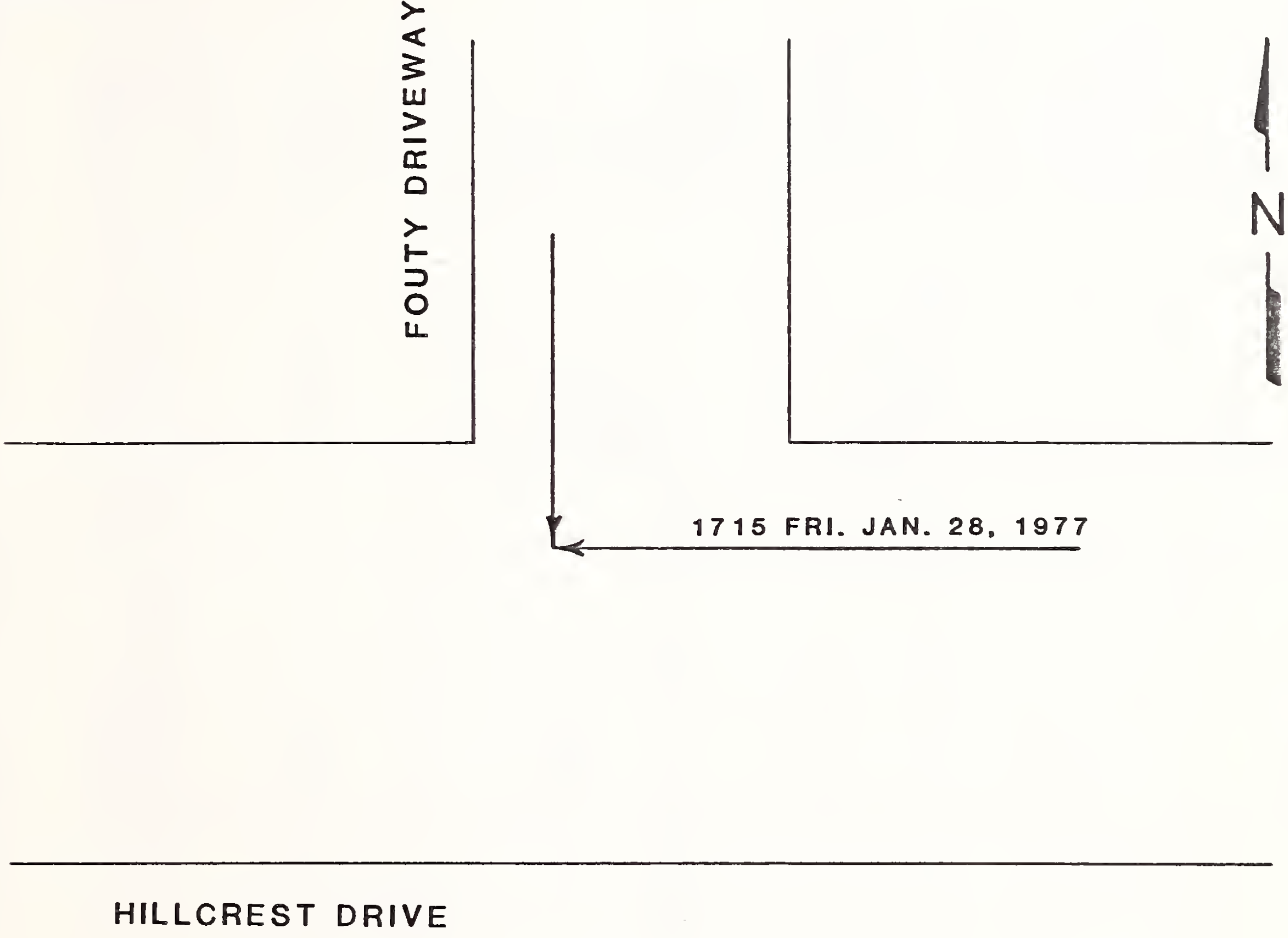
COLLISION DIAGRAM

SITE LOCATION HILLCREST DRIVE AND FOUTY DRIVEWAY

PERIOD 3 YEARS FROM JAN 1, 1977 TO DEC 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 1



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
1 PROPERTY DAMAGE ONLY 0 INJURY OR FATAL 1 TOTAL ACCIDENTS	←—— MOVING VEHICLE ←>>>— BACKING VEHICLE ←— — NON-INVOLVED VEHICLE X— — — — PEDESTRIAN ▭ PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	←←— REAR END →← HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 1-2

ACCIDENT SUMMARY

SITE NUMBER 1 LOCATION HILLCREST DRIVE REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.	1	SUN.		CLEAR	1	DRY	1	Day	1	ANGLE	1	1977 FATAL	
FEB.										LEFT TURN		INJURY	
MARCH		MON.		RAIN		WET				REAR END		PROPERTY DAMAGE ONLY	1
APRIL		TUE.						DAWN OR DUSK		HEAD ON			
MAY										SIDE SWIPE		FATAL	
JUNE		WED.		SNOW		SNOWY						INJURY	
JULY								DARK LIGHTED		PARKED VEHICLE		PROPERTY DAMAGE ONLY	
AUGUST		THURS.								BACKING			
SEPT.				FOG		ICY				FIXED OBJECT		FATAL	
OCT.		FRI.	1					DARK UN LIGHTED		NON COLLIS		INJURY	
NOV.		SAT.		OTHER		OTHER				ANIMAL		PROPERTY DAMAGE ONLY	
DEC.													

TRAFFIC

Peak hour traffic counts were gathered on Wednesday, November 25, 1981 between the hours of 7:30 and 8:30 a.m.. The counts were 15 vehicles east bound and 17 vehicles west bound for a total of 32. Using a morning peak hour factor of .056, the average daily traffic is estimated to be 570 ADT.

The capacity of the roadway for level of Service C operation is 190 vehicles per hour. Therefore, the Volume Capacity ratio is :

$$V/C = \frac{570}{24}(190) \qquad = 0.125$$

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance at the top of the hill is 200 feet. This corresponds to a speed limit of 30 mph. The present posted speed limit is 35 mph. The minimum Safe Stopping Site Distance for this speed is 275 feet. (Table 2). This gives a ratio of 200 divided by 275 = 0.73.

The Driver Expectancy from the east is 4, and from the west is 3, giving a weighted average of 3.67(highest is weighted twice, next highest once).

The Information System Deficiency from the east is 4, and from the west is 3, giving a weighted average of 3.67.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 1-1) indicates the indices and analysis parameters derived from the data collection efforts.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #1

Date December 1981

Description Hill Crest Drive and Fouty Driveway

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	0.33	acc/yr	2	x	0.145	=	.290
Accident Rate	1.59	acc/MEV	34	x	0.199	=	6.766
Accident Severity	4400	dollars	46	x	0.169	=	7.774
Volume/Capacity Ratio	.125		30	x	0.073	=	2.190
Sight Distance Ratio	0.73	(wt.avg.)	61	x	0.066	=	4.026
Driver Expectancy	3.67	(wt.avg.)	61	x	0.132	=	8.052
Info. System Deficiencies	3.67	(wt.avg.)	61	x	0.102	=	6.222
			SUMS:		0.886*		35.32

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{35.32}{0.886} = 39.865$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 1-1

SHORT TERM IMPROVEMENTS

The suggested short term improvements for this location are shown on Figure 1-3. The improvements consist of:

1. Installing two 30 mph speed limit signs.
2. Providing No-passing stripping for 500 feet prior to the crest of the Hill.

TABLE 1-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
24" x 30" Speed Limit Post	2	ea	160.00	$320.00
No passing Stripping	500 ft.	Lump Sum		$200.00
			Total Cost	$520.00

LONG TERM IMPROVEMENTS

If in future years, the traffic volumes, would increase significantly on this section of roadway, it would be desirable to widen the road, provide shoulders, and increase the sight distance at the top of the hill. However, at this time, the conditions do not merit these improvements.

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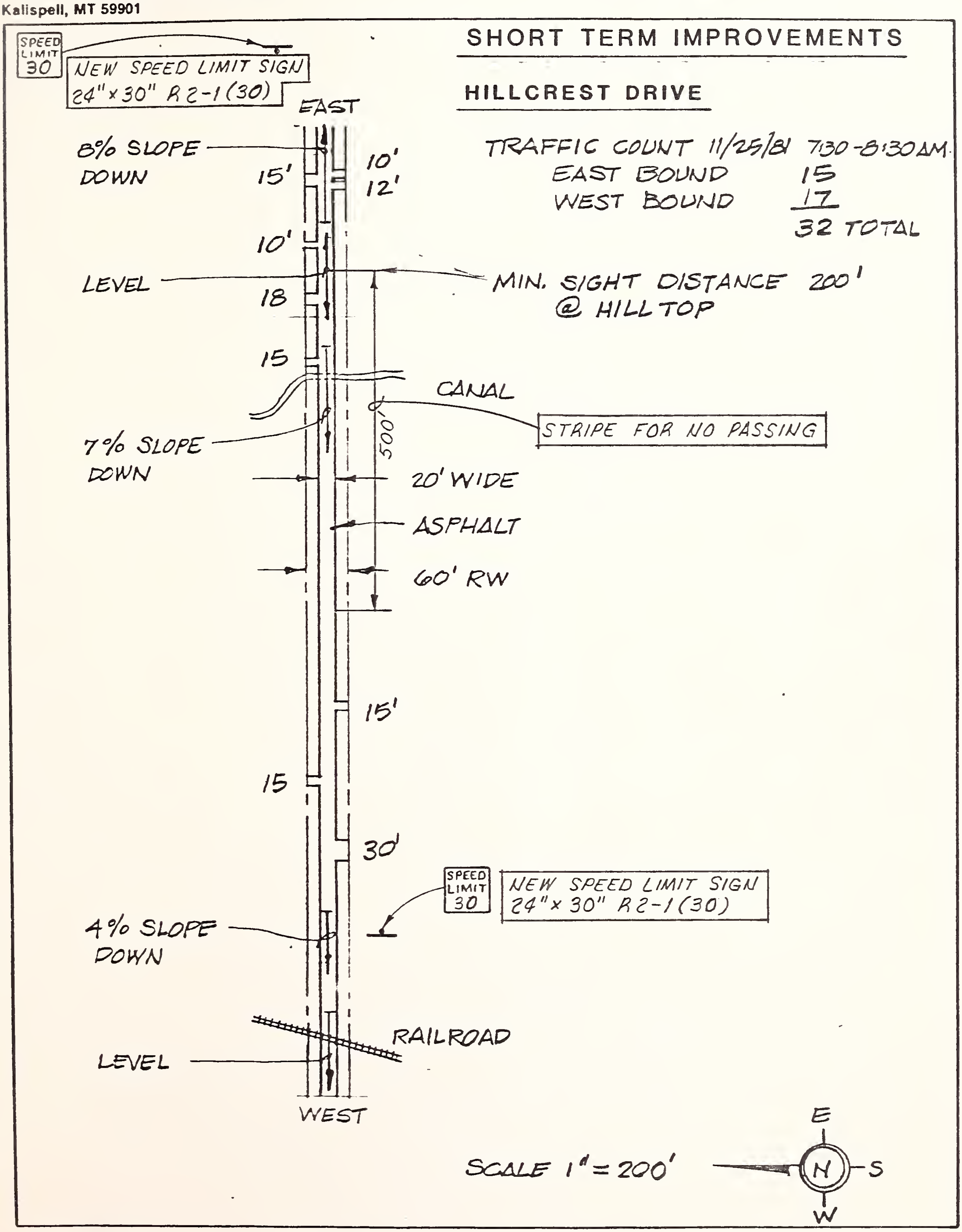
TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ______ BY: ______
DATE ______ CK: ______
SITE #1



SHORT TERM IMPROVEMENTS

HILLCREST DRIVE

TRAFFIC COUNT 11/25/81	7:30-8:30 AM
EAST BOUND	15
WEST BOUND	17
	32 TOTAL

STATE PUBLISHING CO HELENA MONT

Figure 1-3

SITE 2

SITE # 2

KERR DAM ROAD CURVE

LOCATION AND EXISTING CONDITIONS

Site #2 is the first curve out of Polson on the Kerr Dam Road, just west of the City Limits. The roadway has a 24 foot width of asphalt surfacing and the inside shoulder of the curve has a slight dropoff to natural ground. The degree of curvature of the curve is 28.6°, with a super elevation of approximately 0.078 ft. per foot. This relates to a roadway design speed of about 25 mph.*

For vehicles going to the west out of Polson, there is no curve sign or posted advisory speed limit for the curve. The curve occurs just after the vehicles have cleared a residential area, and the natural tendency would be to increase speed.

For vehicles approaching the curve from the south, there is a curve sign with an advisory speed limit plate of 35 mph.

Reference is made to Figure 2-1, which is the existing condition sketch.

ACCIDENT ANALYSIS

During the three year period (1977-1979) there were five accidents at this location. From the Accident Summary Sheet, it can be noted that four of the five accidents occured when conditions were icy. Three of the accidents were single vehicles, failing to negotiate the curve, and the other two accidents involved two vehicles.

*At all sites the design speed was calculated using the equation $V^2 = \frac{85,900}{D}(e+f)$, where V is speed in mph, E is super elevation rate, in feet per foot, F is pavement friction factor, and D is the degree of curvature.

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TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ____ BY: ____
DATE ____ CK: ____
SITE #2

EXISTING CONDITION SKETCH

KERR DAM ROAD

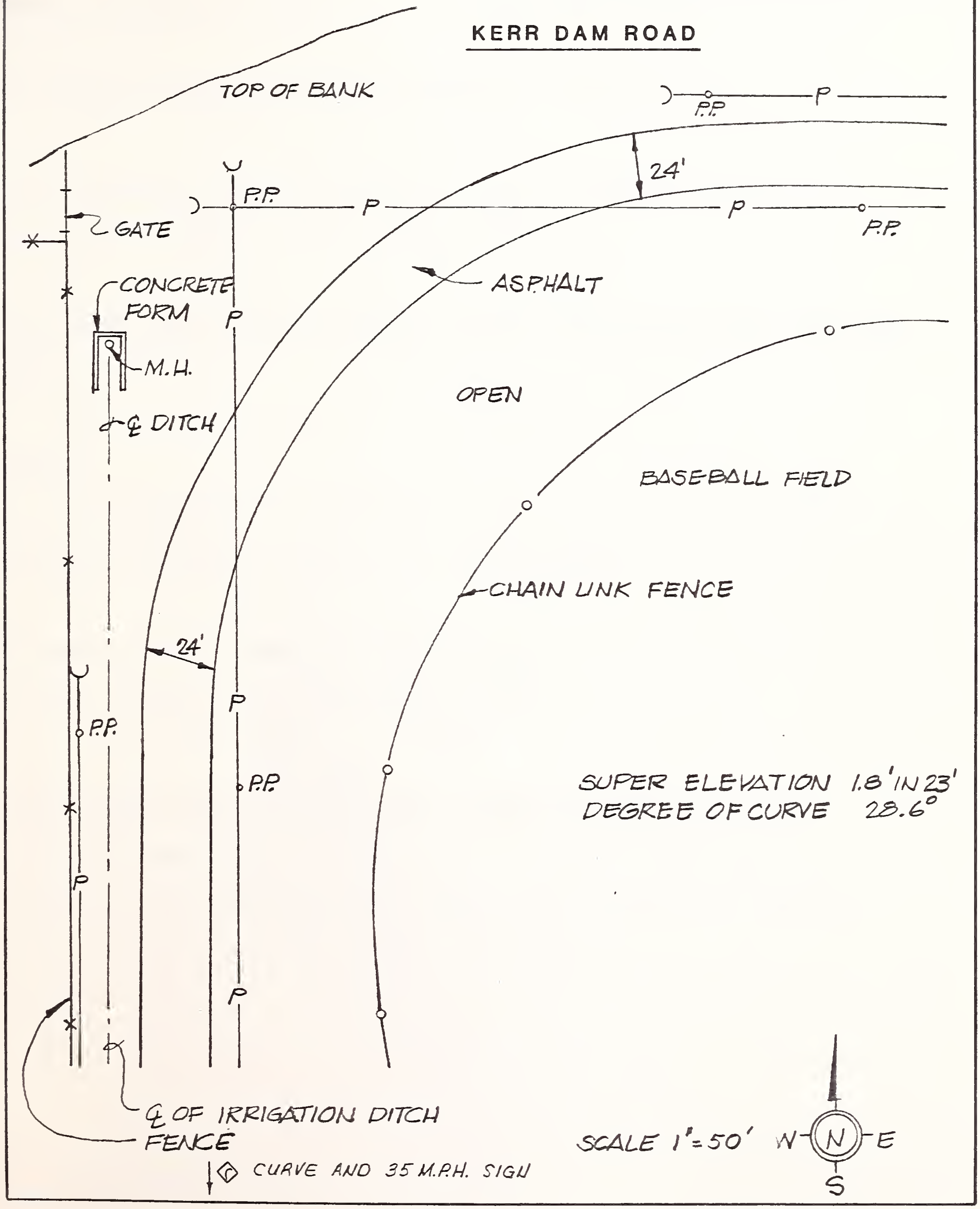


Figure 2-1

Refer to the collision diagram (Figure 2-2), for graphic descriptions of the accidents. The most apparent cause, is lack of adequate warning for the curve, especially during icy periods.

The average accident severity at the location is $15,280.

The average yearly number of accidents is 1.67 accidents per year, with a yearly traffic volume of 0.272 million vehicles.

The accident rate calculates to be 6.14 accidents per million entering vehicles (MEV).

TRAFFIC

The existing Average Daily Traffic for this site was obtained from the Montana Department of Highways. The count for 1981 was 745 ADT.

The capacity of the roadway for level of Service C operation is 230 vehicles per hour. Therefore, the Volume/Capacity Ratio is:

$$V/C = \frac{745}{24\,(230)} = 0.135$$

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance at this curve is greater than 600 feet, which is more than twice the minimum Safe Stopping Sight Distance for a speed of 35 mph. Therefore, the ratio would be greater than 2.0.

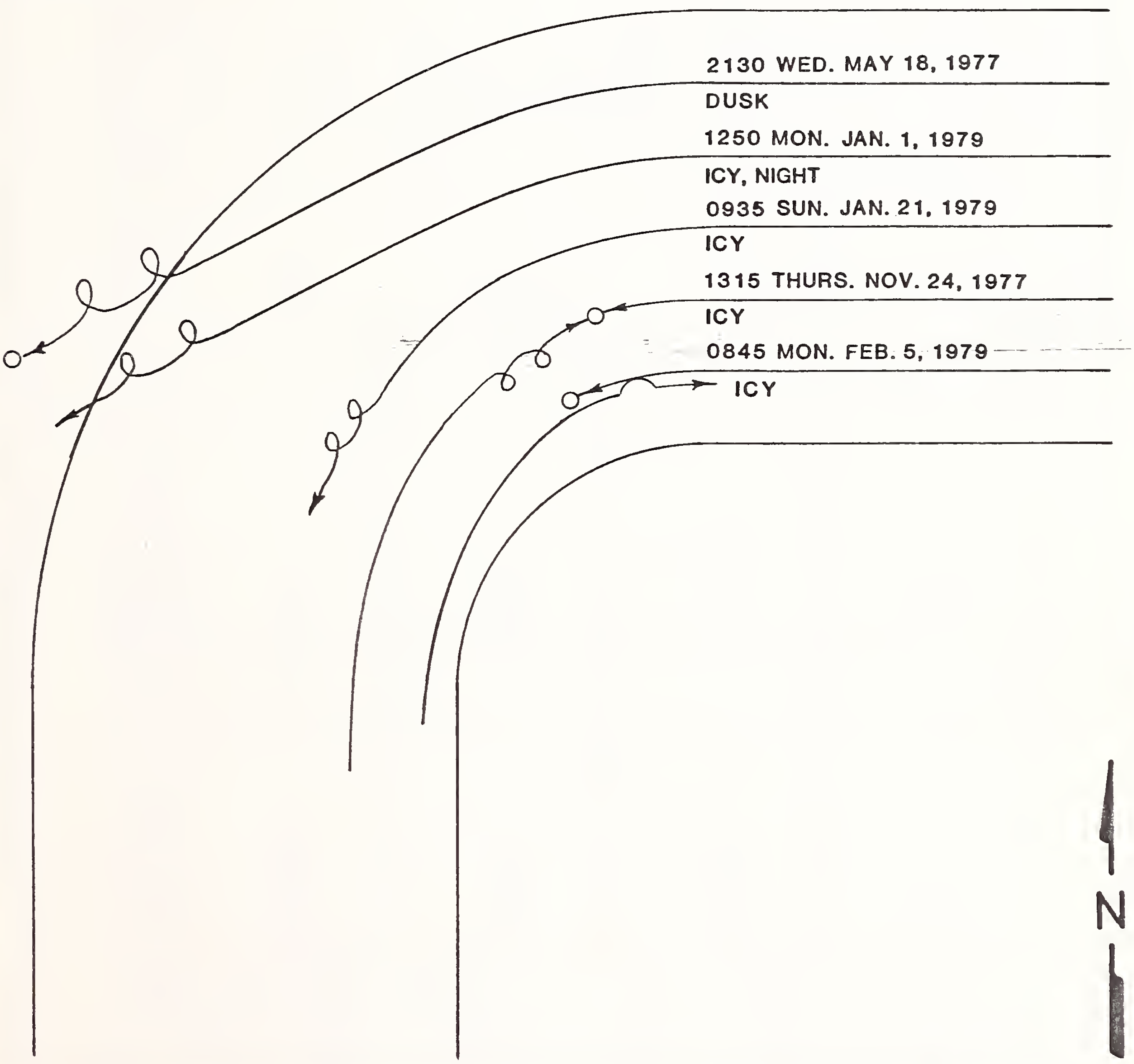
COLLISION DIAGRAM

SITE LOCATION KERR DAM ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 2



2130 WED. MAY 18, 1977
DUSK

1250 MON. JAN. 1, 1979
ICY, NIGHT

0935 SUN. JAN. 21, 1979
ICY

1315 THURS. NOV. 24, 1977
ICY

0845 MON. FEB. 5, 1979
ICY

NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
2 PROPERTY DAMAGE ONLY 3 INJURY OR FATAL 5 TOTAL ACCIDENTS	←—— MOVING VEHICLE ←≫≫ BACKING VEHICLE ← – NON-INVOLVED VEHICLE X– – – – PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 2-2

ACCIDENT SUMMARY

SITE NUMBER 2 LOCATION KERR DAM ROAD REPORTING PERIOD 1977-1979

MONTH	NO.
JAN.	2
FEB.	1
MARCH	
APRIL	
MAY	1
JUNE	
JULY	
AUGUST	
SEPT.	
OCT.	
NOV.	1
DEC.	

DAY OF WK.	NO.
SUN.	1
MON.	2
TUE.	
WED.	1
THURS.	1
FRI.	
SAT.	

WEATHER	NO.
CLEAR	5
RAIN	
SNOW	
FOG	
OTHER	

ROAD CONDITION	NO.
DRY	1
WET	
SNOWY	
ICY	4
OTHER	

LIGHT COND	NO.
Day	3
DAWN OR DUSK	1
DARK LIGHTED	
DARK UN LIGHTED	1

ACCID TYPE	NO.
ANGLE	
LEFT TURN	
REAR END	
HEAD ON	1
SIDE SWIPE	1
PARKED VEHICLE	
BACKING	
FIXED OBJECT	
NON COLLIS	3
ANIMAL	

YEAR & SEVERITY	NO.
1977 / FATAL	
INJURY	1
PROPERTY DAMAGE ONLY	1
1978 / FATAL	
INJURY	
PROPERTY DAMAGE ONLY	
1979 / FATAL	
INJURY	1
PROPERTY DAMAGE ONLY	2

The Driver Expectancy from the east is 5, and from the south is 2, giving a weighted average of 4.00 (Highest is weighted twice, next highest once).

The Information System Deficiency from the east is 5, and from the south is 1, giving a weighted average of 3.67.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 2-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

A close analysis of the accidents at this location, indicated the following:

1. More accidents occured for vehicles traveling west out of town.
2. The majority of the accidents occured when the curve was ice covered.

Also, the roadway width is the same 24 foot width throughout the curve. With the degree of curvature, curve widening on the inside shoulder would give more pavement width for manuvering vehicles on ice. The recommended improvements are:

1. Install turn sign with 25 mph speed advisory plate on both approachs.
2. Install chevron curve alignment signs.
3. Install delineators on each side.
4. Widen inside of curve.

These improvements are shown on Figure 2-3.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #2 Date December 1981

Description Kerr Dam Road Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.67	acc/yr	28	x	0.145	=	4.060
Accident Rate	6.14	acc/MEV	93	x	0.199	=	18.507
Accident Severity	15,280	dollars	76	x	0.169	=	12.844
Volume/Capacity Ratio	.135		32	x	0.073	=	2.336
Sight Distance Ratio	> 2.0	(wt.avg.)	0	x	0.066	=	0
Driver Expectancy	4.00	(wt.avg.)	67	x	0.132	=	8.844
Info. System Deficiencies	3.67	(wt.avg.)	61	x	0.102	=	6.222
			SUMS:		0.886*		52.813

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{52.813}{0.886} = 59.608$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 2-1

TABLE 2-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
W1-1L & W1-1R Turn sign and post (30'' x 30'')	2	ea	180.00	360.00
W 13-1 Speed Advisory Plate (18'' x 18'')	2	ea	35.00	70.00
W1-8 Double Chevron Alignment Signs & Posts (18'' x 24'')	3	ea	180.00	540.00
W1-8 Single Chevron Alignment Signs & Posts (18'' x 24'')	2	ea	130.00	260.00
Design A Delineators & Posts	29	ea	20.00	580.00
3'' Asphalt Pavement with 9'' Base	200	s.y.	15.00	3,000.00
			Total Cost	$ 4,810.00

SE&A

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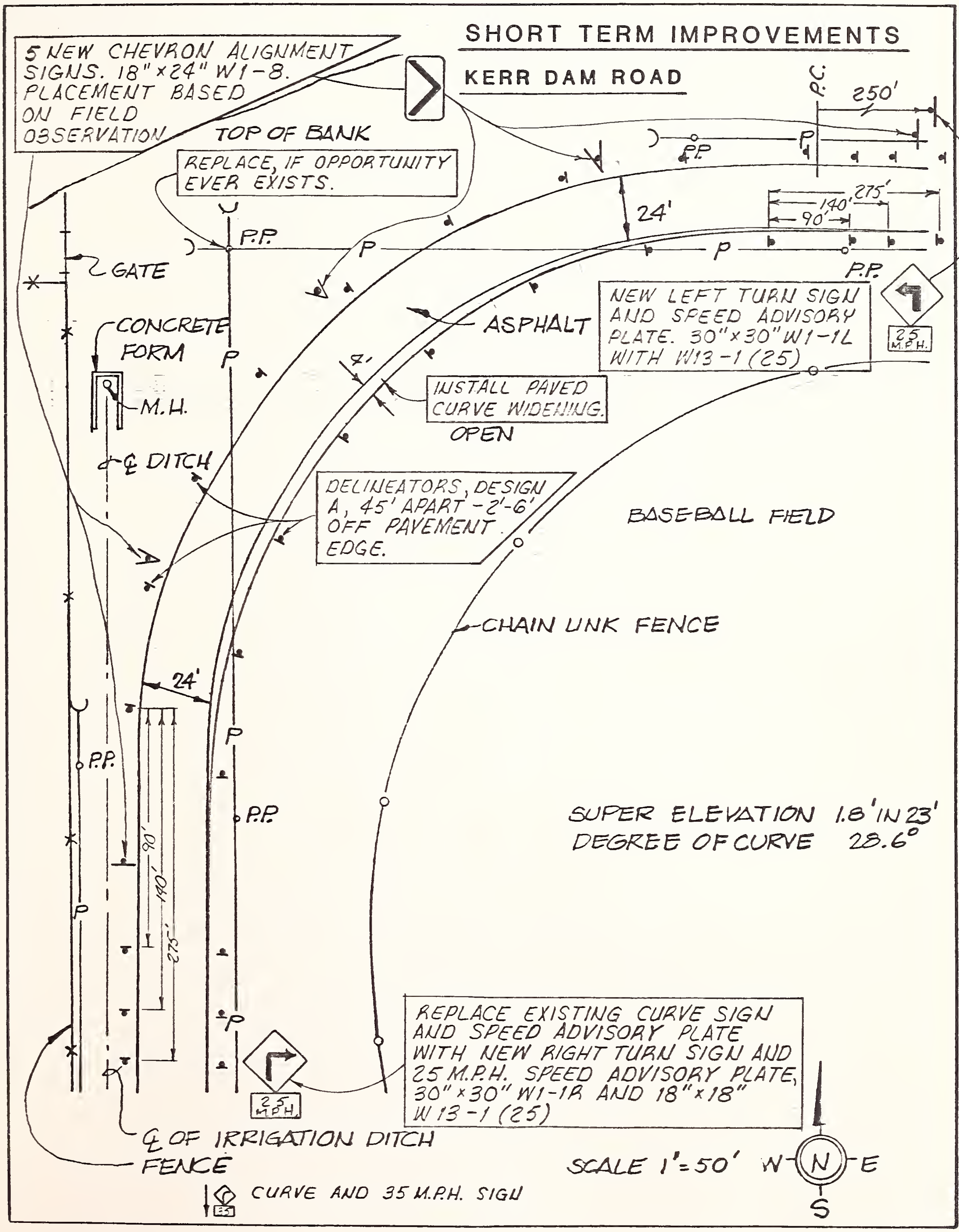
TITLE LAKE CO. TRAFFIC HAZARD STUD
PROJ. NO. ______ BY: ______
DATE ______ CK: ______
SITE #2

SHORT TERM IMPROVEMENTS

KERR DAM ROAD



5 NEW CHEVRON ALIGNMENT SIGNS. 18"×24" W1-8. PLACEMENT BASED ON FIELD OBSERVATION

REPLACE, IF OPPORTUNITY EVER EXISTS.

NEW LEFT TURN SIGN AND SPEED ADVISORY PLATE. 30"×30" W1-1L WITH W13-1 (25)

INSTALL PAVED CURVE WIDENING.

DELINEATORS, DESIGN A, 45' APART - 2'-6' OFF PAVEMENT EDGE.

REPLACE EXISTING CURVE SIGN AND SPEED ADVISORY PLATE WITH NEW RIGHT TURN SIGN AND 25 M.P.H. SPEED ADVISORY PLATE, 30"×30" W1-1R AND 18"×18" W13-1 (25)

SUPER ELEVATION 1.8' IN 23'
DEGREE OF CURVE 28.6°

SCALE 1"=50'

Figure 2-3

SITE 3

SITE # 3

SKYLINE DRIVE

LOCATION AND EXISTING CONDITIONS

Site # 3 is Skyline Drive on the south side of Polson. This section of Skyline Drive is where Main Street turns to the east, becoming Skyline Drvie.

The roadway is on a hillside, with the south side of the road being a cut slope, and the north side a steep embankment. The roadway is a agravel surface with an average width of 20 feet. It has a continous slope of 8% uphill going to the east. The road has numerous curves, with degrees of curvature ranging up to 22.9°. Without any defined super elevation, the 22.9° curvature relates to a 20 mph design speed.

The area at the east end of this section of Skyline Drive, (the top of the hill) has some new housing developments beginning. The area does appear to be a prime area for further growth and development.

Reference is made to Figure 3-1, which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

During the three year period (1977-1979), there were three accidents on this stretch of Skyline Drive. From the Accident Summary Sheet, it can be seen that no clear pattern exists with regard to the accidents. Since the road has numerous curves, and has a steep grade, it could be expected that the accidents would occur during icy or snowy conditions.

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. BY
DATE CK
SITE # 3

EXISTING CONDITION SKETCH

SKYLINE DRIVE

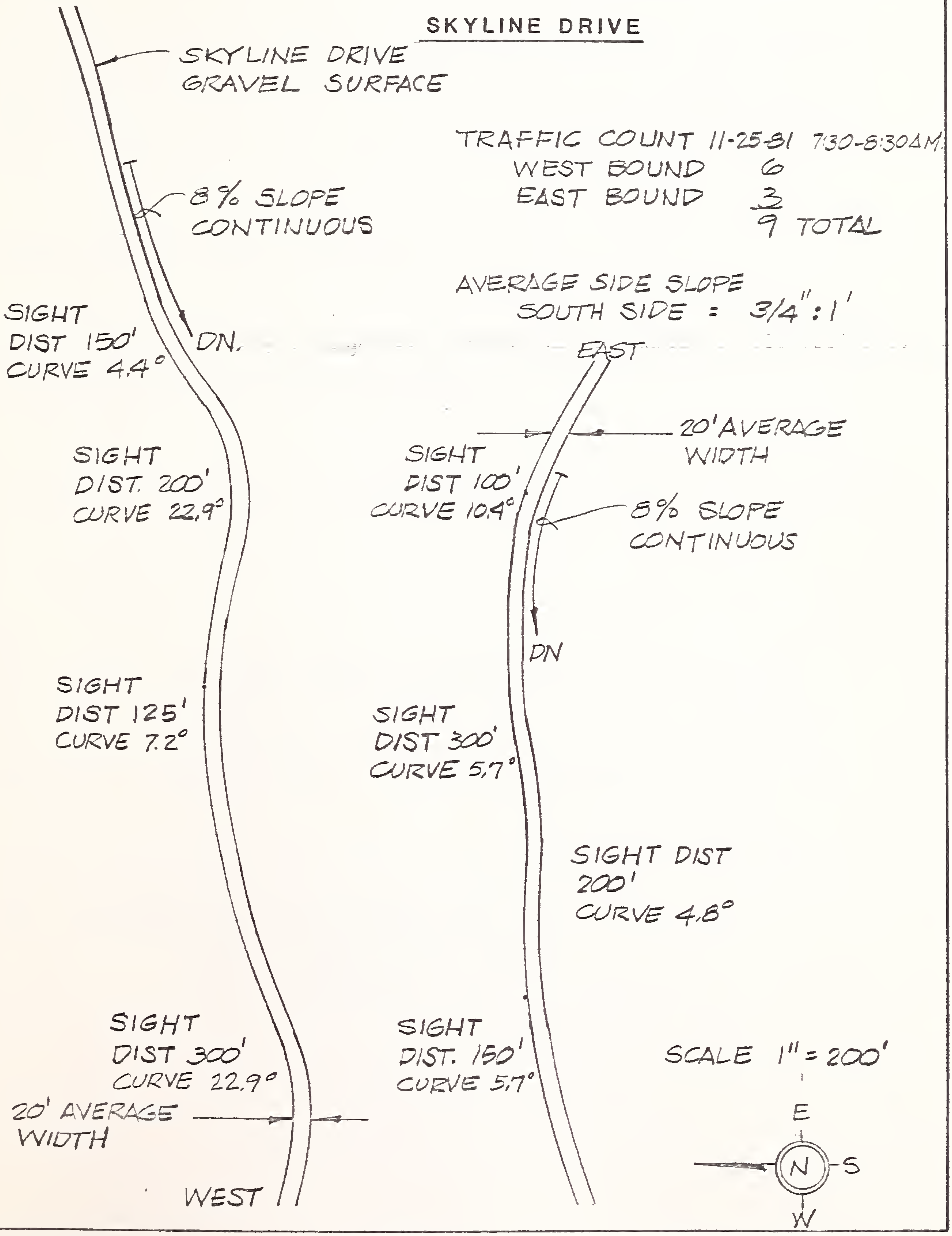


Figure 3-1

However, this was not the case. Two of the accidents did occur at night, the third accident occured going up hill, and it was reportedly caused by a medical condition of the driver.

Reference is made to the collision diagrams (Figure 3-2), for graphic descriptions of the accidents. It would appear, the most apparent cause would be, speed too fast to negotiate curves on a gravel surfaced roadway.

The average accident severity at the site is $16,133.

The average yearly number of accidents is 1.00 accidents per year, with a yearly traffic volume of 0.058 million vehicles.

The accident rate calculates to be 17.24 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were taken at this location between the hours of 7:30 and 8:30 a.m. on Wednesday, November 25, 1981. The total count was 9 vehicles, giving a count of 160 ADT (a peak hour factor of .056 was used).

The capacity of the roadway for level of Service C operation is 180 vehicles per hour. Therefore, the Volume/Capacity Ratio is:

$$V/C = \frac{160}{24\ (180)} = 0.037$$

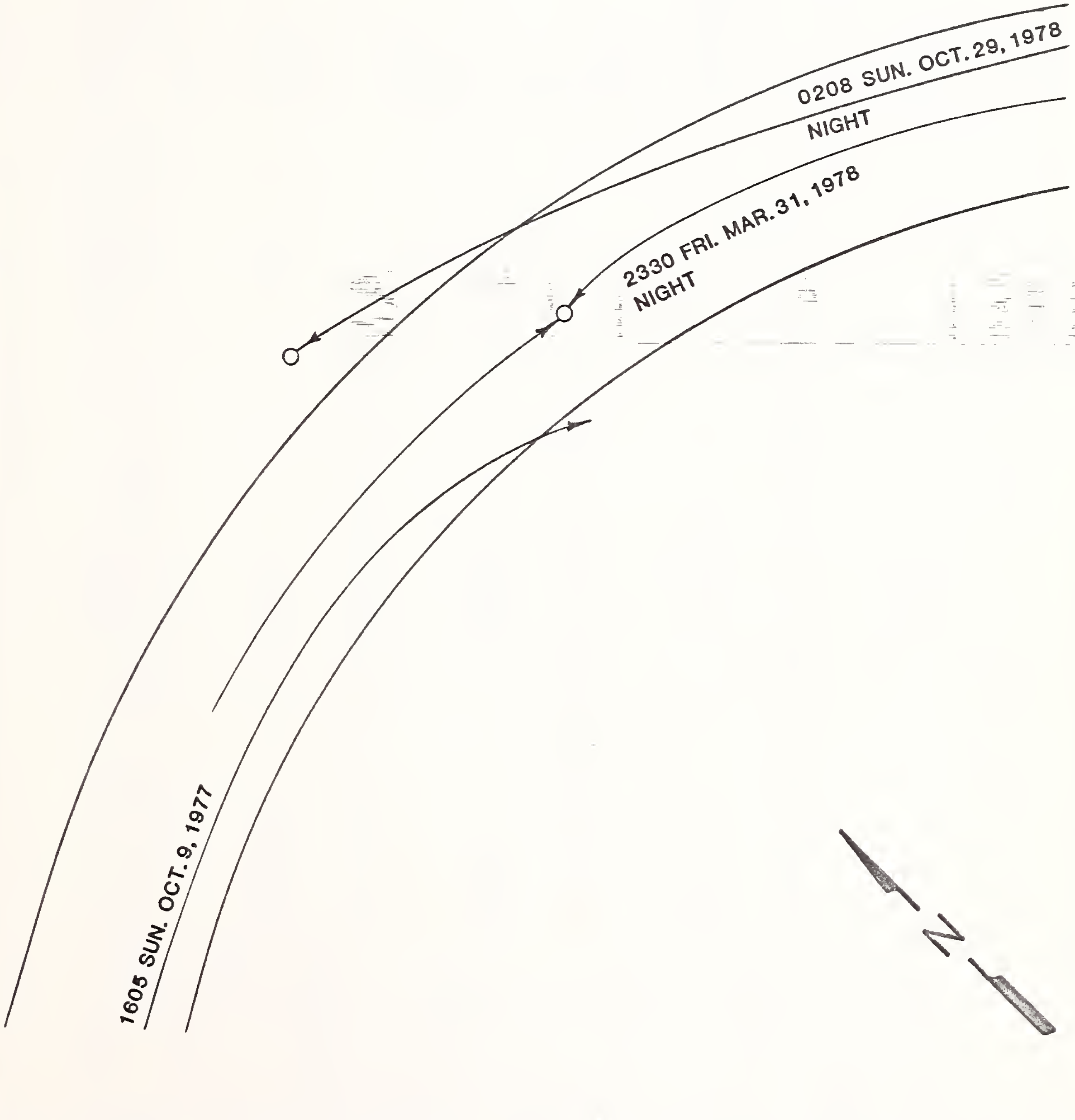
COLLISION DIAGRAM

SITE LOCATION SKYLINE DRIVE

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 3



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
1 PROPERTY DAMAGE ONLY 2 INJURY OR FATAL 3 TOTAL ACCIDENTS	← MOVING VEHICLE BACKING VEHICLE ← — NON-INVOLVED VEHICLE X- - - - PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 3-2

ACCIDENT SUMMARY

SITE NUMBER 3 LOCATION SKYLINE DRIVE REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.	2	CLEAR	3	DRY	3	Day	1	ANGLE		1977 FATAL	
FEB.										LEFT TURN		INJURY	
MARCH	1	MON.								REAR END		PROPERTY. DAMAGE ONLY	1
APRIL				RAIN		WET		DAWN OR DUSK		HEAD ON	1	1978 FATAL	
MAY		TUE.								SIDE SWIPE		INJURY	2
JUNE										PARKED VEHICLE		PROPERTY DAMAGE ONLY	
JULY		WED.		SNOW		SNOWY		DARK LIGHTED		BACKING		FATAL	
AUGUST										FIXED OBJECT		INJURY	
SEPT.		THURS.		FOG		ICY				NON COLLIS	2	PROPERTY DAMAGE ONLY	
OCT.	2							DARK UN LIGHTED	2	ANIMAL			
NOV.		FRI.	1	OTHER		OTHER							
DEC.		SAT.											

SIGHT DISTANCE, DRIVE EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

There are a series of curves on this section of roadway that have differing sight distances, because of embankments, brush in gullies, and the degree of curvature. The sight distances are 100, 125, 150, 150, 200, 300, 300, feet respectively. Although there is not a posted speed limit, we will assume a 30 mph speed to calculate the ratios. The maximum Safe Stopping Site Distance for this speed is 200 feet. Only the two shortest existing sight distances will be analyzed, since they are the ones used to average the final Indicator Value. Therefore the ratios are 100 divided by 200 = 0.500 and 125 divided by 200 = 0.625 giving a weighted average of 0.54.

The Driver Expectancy from the east is 2 and from the west is 0, giving a weighted average of 1.33 (Highest is weighted twice, next highest once).

The information System Deficiency from the east is 4 and from the west is 1, giving a weighted average of 3.00.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 3-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The short term improvements suggested for this location are based on the fact that vehicles traveling from the east, toward town, need to be warned of the road with numerous curves, also the edge of the roadway on the embankment side needs to be delineated.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #3

Date December 1981

Description Sky Line Drive

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.00	acc/yr	21	x	0.145	=	3.045
Accident Rate	17.24	acc/MEV	100	x	0.199	=	19.900
Accident Severity	16,133	dollars	77	x	0.169	=	13.013
Volume/Capacity Ratio	.037		15	x	0.073	=	1.095
Sight Distance Ratio	0.54	(wt.avg.)	90	x	0.066	=	5.940
Driver Expectancy	1.33	(wt.avg.)	22	x	0.132	=	2.904
Info. System Deficiencies	3.00	(wt.avg.)	50	x	0.102	=	5.100
			SUMS:		0.886*		50.997

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{50.997}{0.886} = 57.559$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 3-1

The recommended improvements are:

1. Install new winding road sign with 20 mph speed advisory plate at top of hill, for west bound traffic.

2. Install delineators on the embankment side for the entire section of roadway.

3. Widen the embankment at one curve. These improvements are shown

on Figure 3-3.

TABLE 3-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Winding Road Sign with post (30" x 30")	1	ea	180.00	180.00
Speed Advisory Plate	1	ea	35.00	35.00
Delineators	21	ea	20.00	420.00
Embankment	350	c.y.	4.00	1,400.00
9" Gravel	110	s.y.	7.00	770.00
			Total Cost	$2,805.00

LONG TERM IMPROVEMENTS

This appears to be an area of Polson where future development might occur. There are some good view areas. If this development takes place, and the traffic increases dramatically, it is suggested the following improvements should be considered.

SE&A
STAHLY ENGINEERING & ASSOCIATES
1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STU
PROJ. NO. ________ BY ________
DATE ________ CK: ________
SITE # 3

SHORT TERM IMPROVEMENTS

SKYLINE DRIVE

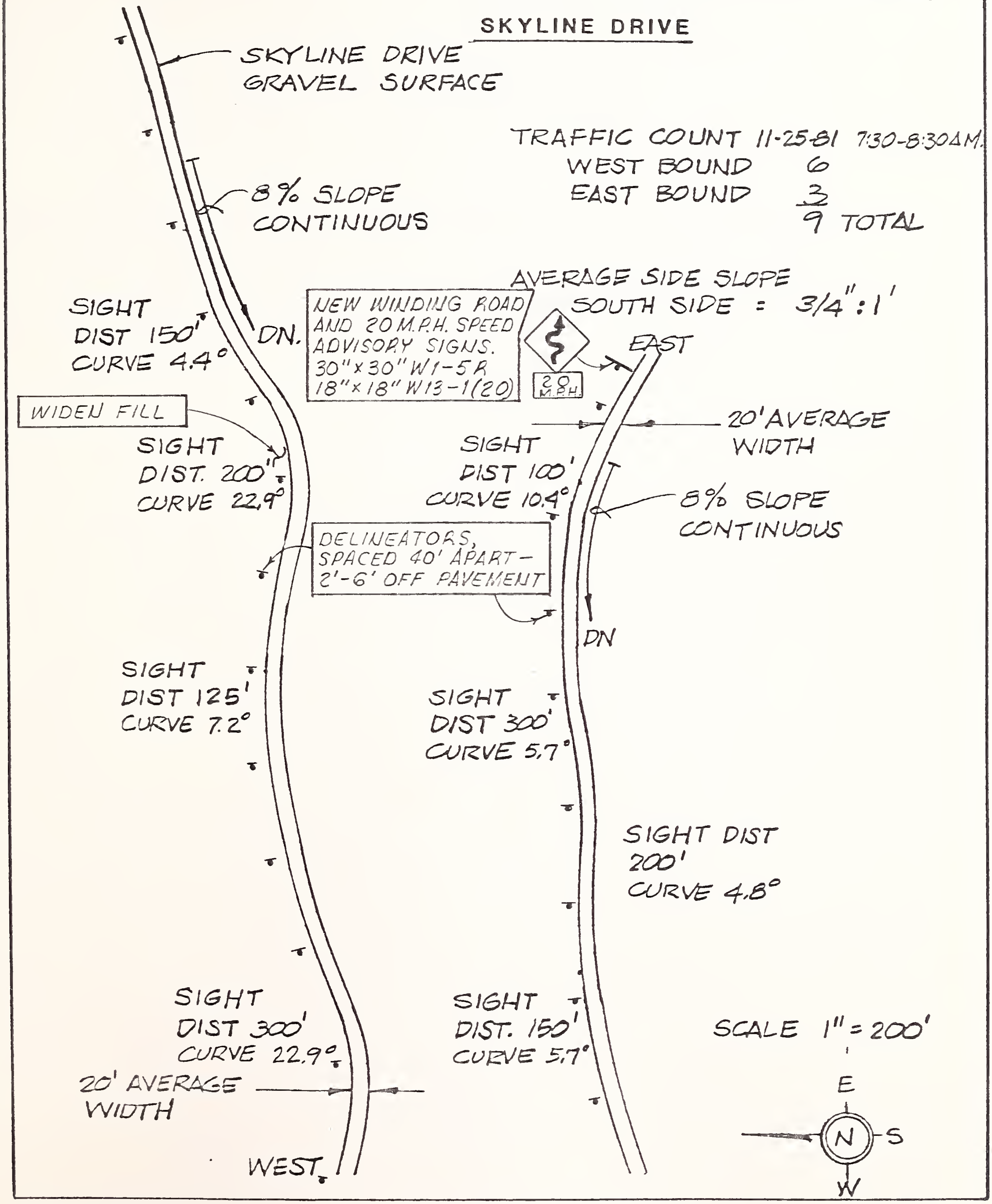

SKYLINE DRIVE
GRAVEL SURFACE
TRAFFIC COUNT 11-25-81 7:30-8:30 A.M.
WEST BOUND 6
EAST BOUND 3
9 TOTAL
8% SLOPE CONTINUOUS
AVERAGE SIDE SLOPE SOUTH SIDE = 3/4":1'
SIGHT DIST 150' CURVE 4.4°
DN.
NEW WINDING ROAD AND 20 M.P.H. SPEED ADVISORY SIGNS.
30"x30" W1-5R
18"x18" W13-1(20)
20 M.P.H.
EAST
WIDEN FILL
SIGHT DIST. 200' CURVE 22.9°
SIGHT DIST 100' CURVE 10.4°
20' AVERAGE WIDTH
8% SLOPE CONTINUOUS
DELINEATORS, SPACED 40' APART - 2'-6' OFF PAVEMENT
DN
SIGHT DIST 125' CURVE 7.2°
SIGHT DIST 300' CURVE 5.7°
SIGHT DIST 200' CURVE 4.8°
SIGHT DIST 300' CURVE 22.9°
SIGHT DIST. 150' CURVE 5.7°
SCALE 1" = 200'
20' AVERAGE WIDTH
WEST
E
N
S
W

Figure 3-3

1. Widen roadway to two 12' lanes and two 4' shoulders, giving a total width of 32'.
2. Surface the road with Asphalt Pavement.
3. Stripe the road for no-passing.
4. Install guardrail along the embankment side.
5. Cut back slopes to increase sight distances.

Funding for these improvements should probably come form the parties that are creating a demand on the roadway. It would be suggested that creation of a Rural Special Improvement District might be considered.

SITE 4

SITE # 4

IRVING FLATS ROAD WEST OF POLSON

LOCATION AND EXISTING CONDITIONS

Site #4 consists of two different locations about one mile apart on the road to the Irving Flats area. The locations are about three and four miles west of Polson.

The first location, four miles west of Polson, is at a county road Tee intersection. The roads are graveled, with a width of 22 to 24 feet.

The second location is three miles west of Polson on the same road. At this location, there is a 90° right turn, where the road drops down in a series of curves, to cross Weythman Gulch. The right turn occurs after a straight stretch of two and one half miles. There is a curve sign to the east of this curve.

The curve has a degree of curvature of approximately 42°, with a super elevation of about 3%. This corresponds to a design speed of 15 mph. The roadway surfacing is gravel.

Reference is made to Figure 4-1 and 4A-1 which are the Existing Condition Sketches of the locations

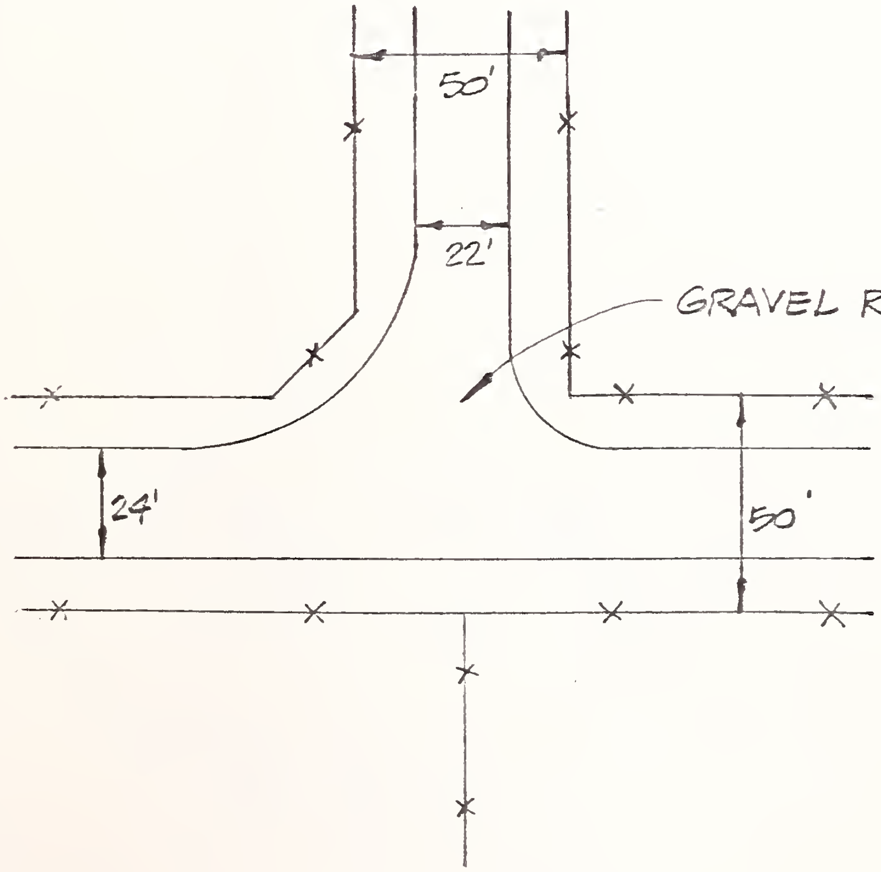
STAHLY ENGINEERING & ASSOCIATES
1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO ____ BY: ____
DATE ____ CK: ____
SITE #4

EXISTING CONDITION SKETCH

IRVINE FLATS ROAD

MIN. SIGHT DISTANCE 500'



SCALE 1"=50'

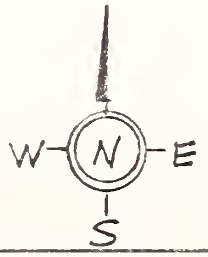


Figure 4-1

SE&A
Stahly
Engineering
&
Associates

1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ______ BY: ______
DATE ______ CK: ______
SITE # 4A

EXISTING CONDITION SKETCH

IRVINE FLATS ROAD

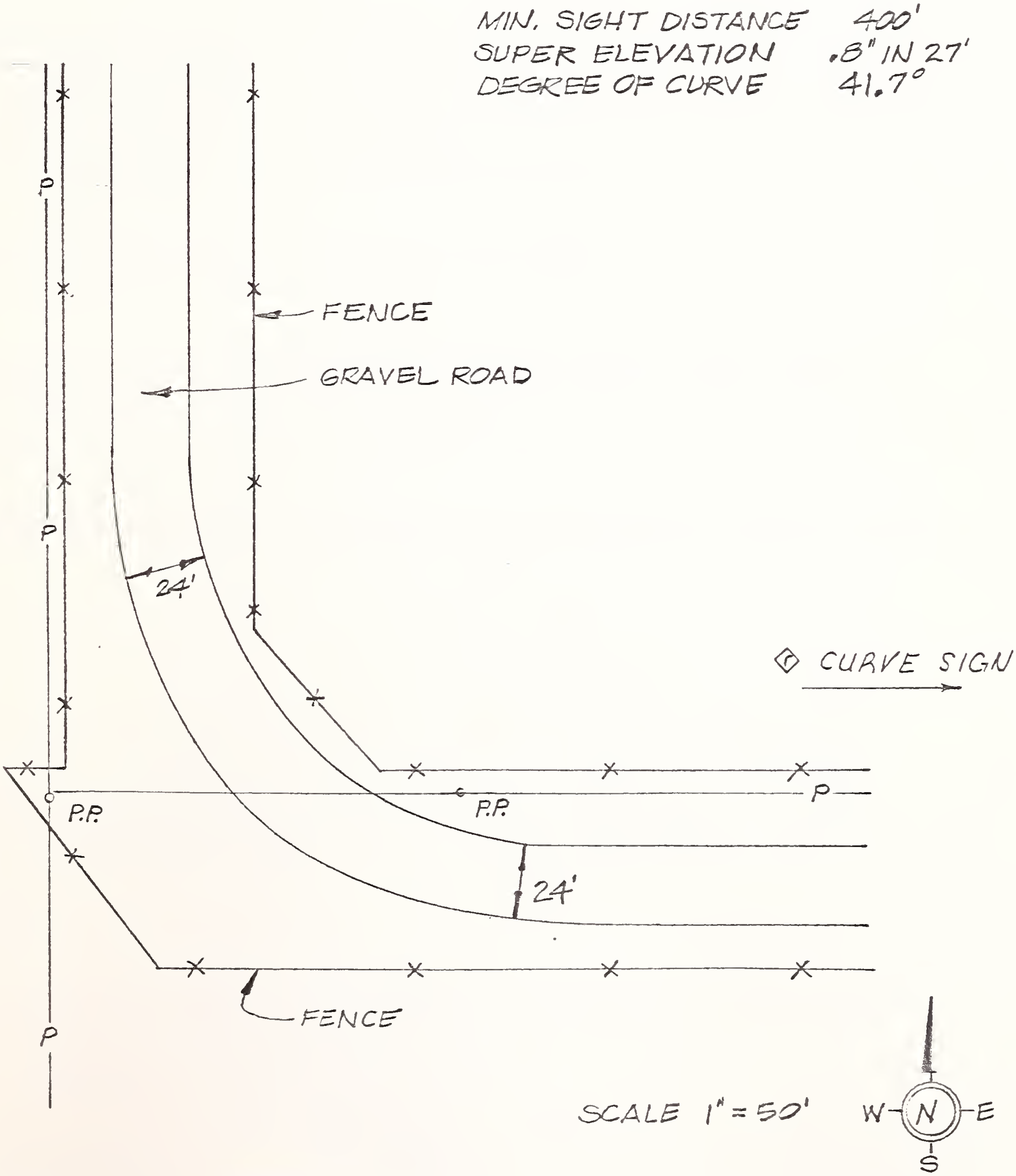

MIN. SIGHT DISTANCE 400'
SUPER ELEVATION .8" IN 27'
DEGREE OF CURVE 41.7°

Figure 4A-1

ACCIDENT ANALYSIS

During the three year period (1977 to 1979), there was one accident at the Tee intersection, which is Site 4. From the accident summary sheet, and the Collision Diagram, Figure 4-2, it can be seen that the accident was a single vehicle accident. The vehicle went out of control on a wash-board section of the roadway.

Site 4-A did not have any accidents reported during the three year period. However, in 1976 there was a single vehicle accident, where the vehicle failed to negotiate the curve. This was a late night accident that involved alcohol.

The average accident severity at the site is \$10,500.

The average yearly number of accidents is 0.33 accidents per year, with a yearly traffic volume of 0.011 million vehicles.

The accident rate calculates to be 30.00 accidents per million entering vehicles (MEV).

TRAFFIC

Average Daily Traffic counts were used from previous years, and factored to 1981. These counts were available from the Montana Department of Highways. The count established is 30 ADT, so it is apparent that this is a very low volume road.

The capacity of the roadway for level of Service C operation is 240 vehicles per hour. Therefore the Volume/Capacity Ratio is:

$$V/C = \frac{30}{24\ (240)} = 0.005$$

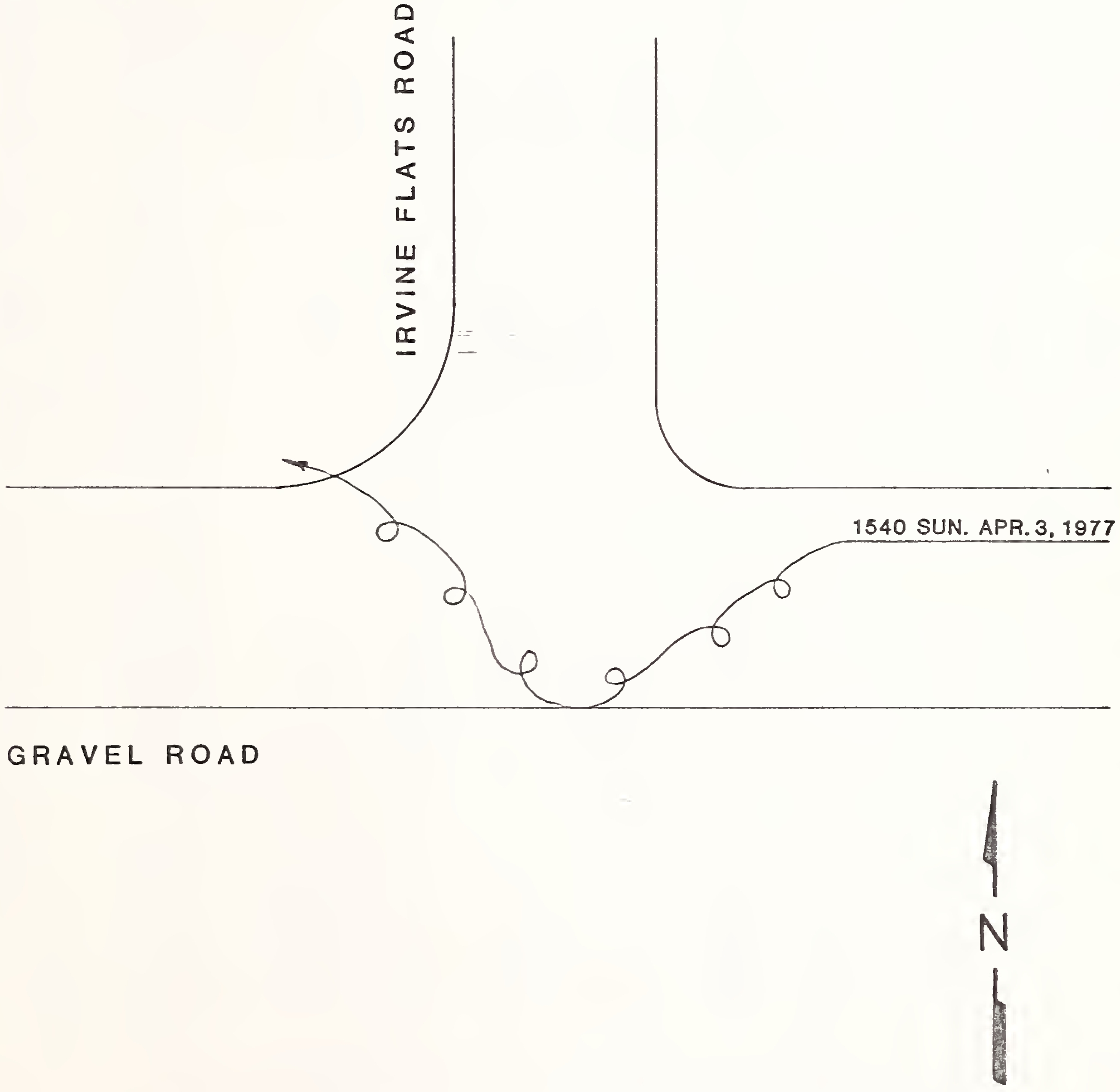
COLLISION DIAGRAM

SITE LOCATION IRVINE FLATS ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 4



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
1 PROPERTY DAMAGE ONLY 0 INJURY OR FATAL 1 TOTAL ACCIDENTS	←—— MOVING VEHICLE ←>>>— BACKING VEHICLE ← — NON-INVOLVED VEHICLE X— — — PEDESTRIAN ▨ PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	←←— REAR END →← HEAD ON ⌒ SIDE SWIPE ∽○○○ OUT OF CONTROL ↗ LEFT TURN ↱ RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 4-2

ACCIDENT SUMMARY

SITE NUMBER 4 LOCATION IRVINE FLATS ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.	1	CLEAR	1	DRY	1	Day	1	ANGLE		1977 FATAL	
FEB.										LEFT TURN		INJURY	
MARCH		MON.		RAIN		WET				REAR END		PROPERTY. DAMAGE ONLY	1
APRIL	1	TUE.						DAWN OR DUSK		HEAD ON			
MAY										SIDE SWIPE		FATAL	
JUNE		WED.		SNOW		SNOWY						INJURY	
JULY								DARK LIGHTED		PARKED VEHICLE		PROPERTY DAMAGE ONLY	
AUGUST		THURS.		FOG		ICY				BACKING			
SEPT.										FIXED OBJECT		FATAL	
OCT.		FRI.						DARK UN LIGHTED		NON COLLIS	1	INJURY	
NOV.		SAT.		OTHER		OTHER				ANIMAL		PROPERTY DAMAGE ONLY	
DEC.													

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

Since the improvements which will be recommended, will be for location 4A, the Sight Distance, Driver Expectancy, and Information System Deficiency Analysis will be made for that location.

The Sight Distance is 400 feet at the curve, which is greater than double the minimum safe stopping site distance for the speed on the curve. Therefore, the ratio would be greater than 2.0.

The Driver Expectancy from both directions is 2.

The Information System Deficiency is 3 from both directions.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 4-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The recommended improvements will be suggested for only the curve, and not the Tee Intersection. It is felt, the intersection accident was not caused by any physical or geometric conditions associated with the roadway.

However, the curve does present a hazard since it occurs, suddenly after several miles of straight roadway.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #4 Date December 1981

Description Irvine Flats Road West of Polson

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	0.33	acc/yr	2	x	0.145	=	0.290
Accident Rate	30.00	acc/MEV	100	x	0.199	=	19.900
Accident Severity	10,500	dollars	62	x	0.169	=	10.478
Volume/Capacity Ratio	.005		3	x	0.073	=	0.219
Sight Distance Ratio	72.0	(wt.avg.)	0	x	0.066	=	0
Driver Expectancy	2.00	(wt.avg.)	33	x	0.132	=	4.356
Info. System Deficiencies	3.00	(wt.avg.)	50	x	0.102	=	5.100
			SUMS:		0.886*		40.343

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{40.343}{0.886} = 45.534$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 4-1

The suggested improvements are:

1. Replace existing curve sign with a winding road sign and 15 mph speed advisory plate.
2. Install large arrow sign.

These improvements are shown on Figure 4A-3.

TABLE 4-2

COST ESTIMATE

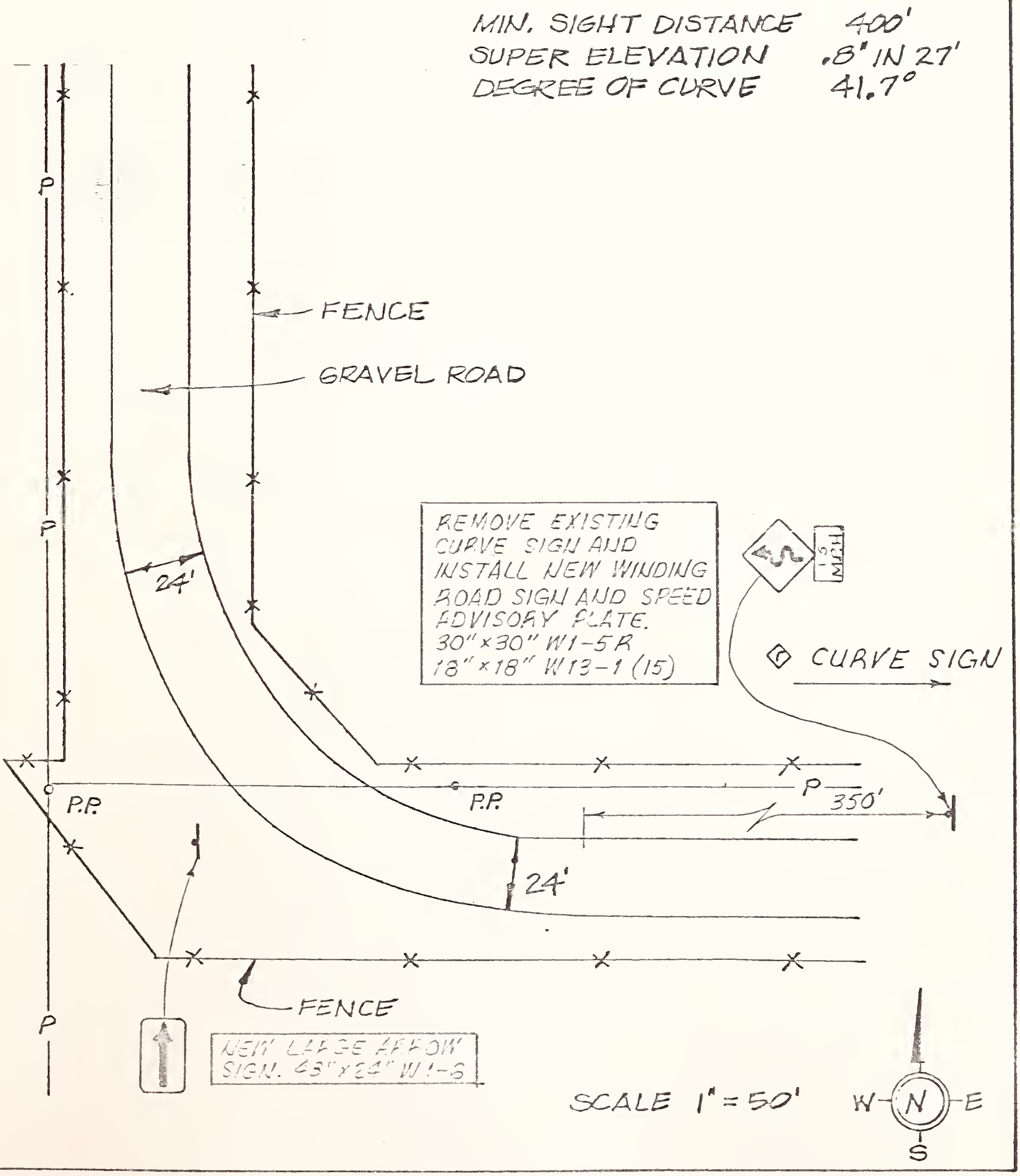
SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Winding Road sign with post (30" x 30")	1	ea	180.00	180.00
Speed Advisory Plate (18" x 18")	1	ea	35.00	35.00
Large Arrow Sign with Post	1	ea	210.00	210.00
			Total Cost	$ 425.00

TITLE LAKE CO. TRAFFIC HAZARD STUD
PROJ. NO. ____ BY: ____
DATE ____ CK: ____
SITE # 4A

SHORT TERM IMPROVEMENTS

IRVINE FLATS ROAD



MIN. SIGHT DISTANCE 400'
SUPER ELEVATION .8" IN 27'
DEGREE OF CURVE 41.7°

REMOVE EXISTING CURVE SIGN AND INSTALL NEW WINDING ROAD SIGN AND SPEED ADVISORY PLATE.
30"×30" W1-5R
18"×18" W13-1 (15)

NEW LARGE ARROW SIGN. 48"×24" W1-6

State Publishing Co. Helena Mont

Figure 4A-3

SITE 5

SITE # 5

COUNTY ROAD AND TURTLE LAKE ROAD

LOCATION AND EXISTING CONDITIONS

Site #5 is at a Tee intersection, on the Turtle Creek Road two and one half miles east of Highway #35/Highway #93 junction, and one mile south of Highway 35.

The one mile of road between the intersection and Highway #35, has an 18 foot wide asphalt surface. The other two legs of the intersection are gravel surfaced. The road to the south is 18 feet wide and the road to the west is 24 feet wide.

There is a posted speed limit of 35 mph on the north/south road. There are trees at the intersection making visability difficult, when approaching the intersection.

Reference is made to Figure 5-1, which is the existing condition sketch.

ACCIDENT ANALYSIS

During the three year period,(1977 - 1979), there were three accidents at this site. Referring to the Collision Diagram (Figure 5-2), two of the accidents could have been caused by restricted sight distances at the intersection. The other accident involved icy conditions, along with a vehicle passing while the other was attempting a left turn.

TITLE LAKE CO TRAFFIC HAZARD STUDY
PROJ. NO. ____________ BY: ____________
DATE ____________ CK: ____________
SITE #5

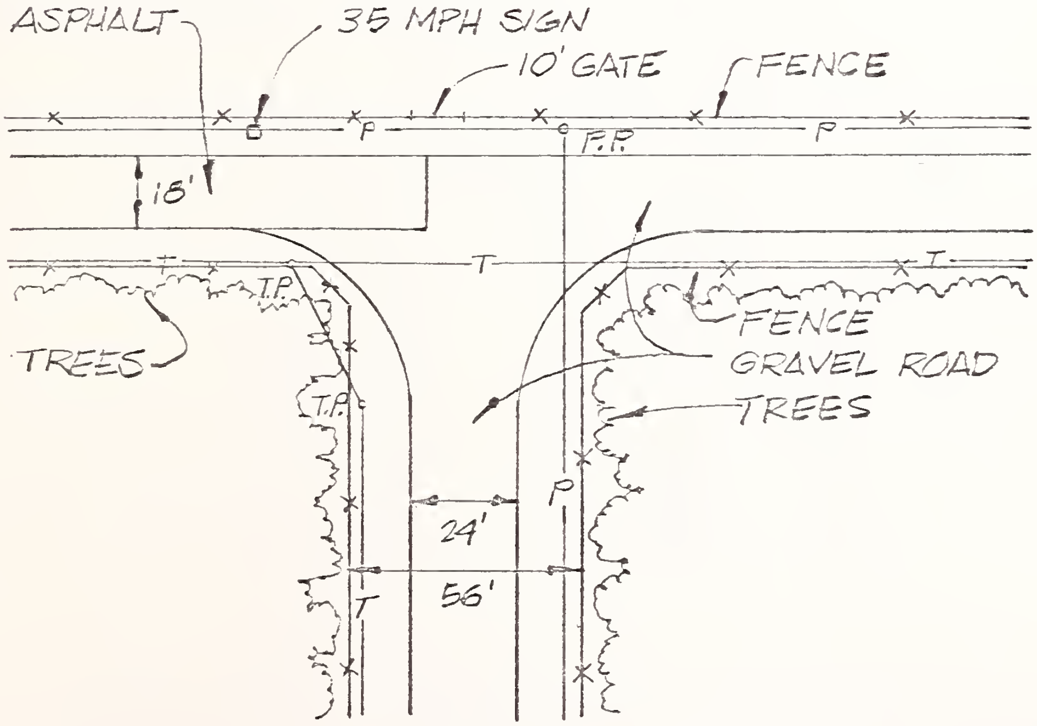
EXISTING CONDITION SKETCH

INTERSECTION OF COUNTY ROAD AND TURTLE LAKE ROAD

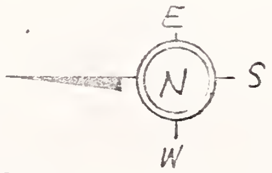
TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.

WEST BOUND	10
EAST BOUND	13
SOUTH BOUND	2
	25 TOTAL

MIN. SIGHT DISTANCE 75'



SCALE 1" = 50'



State Publishing Co. Helena, Mont.

Figure 5-1

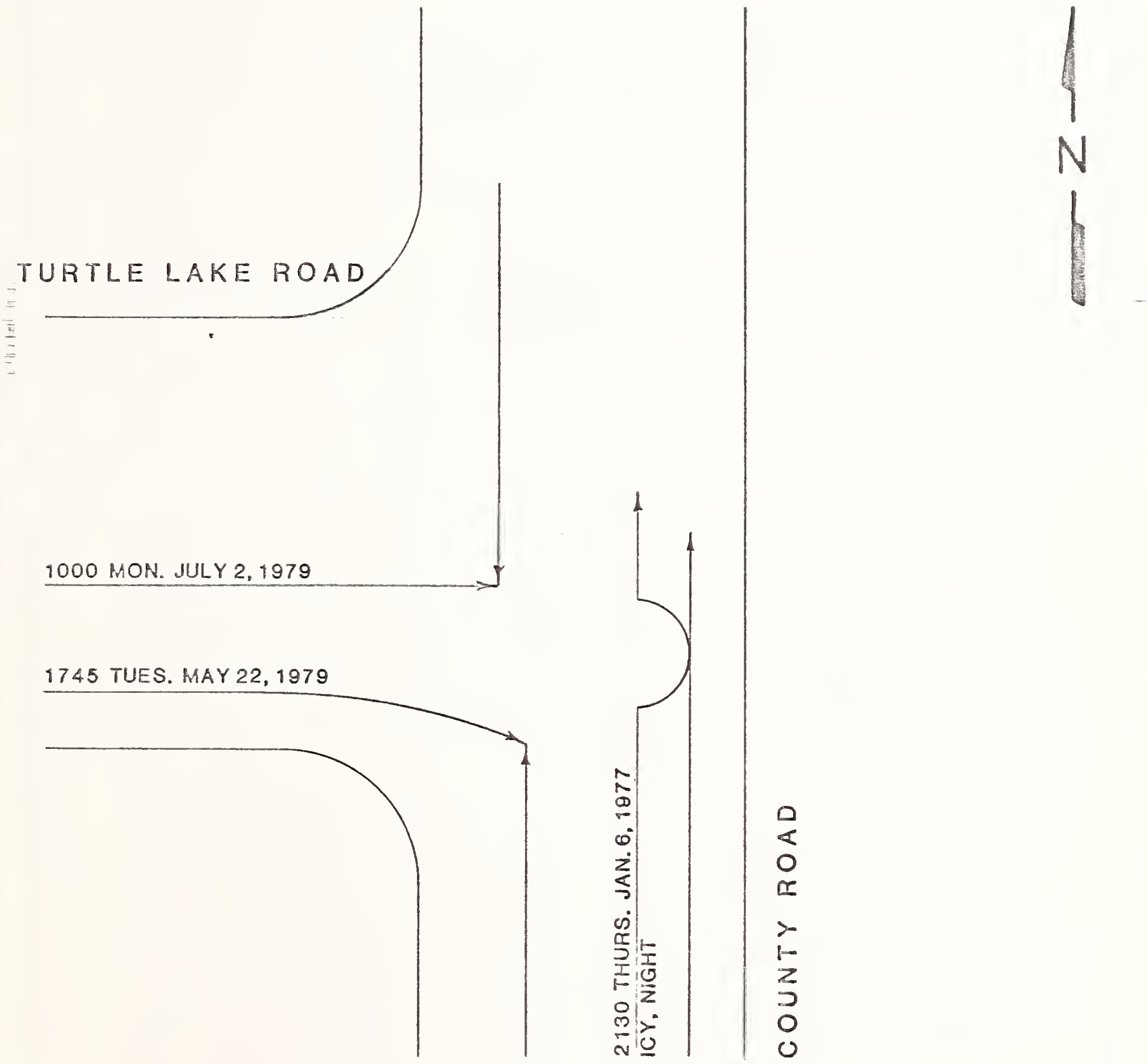
COLLISION DIAGRAM

SITE LOCATION TURTLE LAKE ROAD AND COUNTY ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 5



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
3 PROPERTY DAMAGE ONLY 0 INJURY OR FATAL 3 TOTAL ACCIDENTS	← MOVING VEHICLE BACKING VEHICLE NON-INVOLVED VEHICLE X– – – PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 5-2

ACCIDENT SUMMARY

SITE NUMBER 5 LOCATION COUNTY ROAD AND TURTLE LAKE ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.	1	SUN.		CLEAR	3	DRY	2	Day	2	ANGLE	2	1977 FATAL	
FEB.		MON.	1							LEFT TURN	1	INJURY	
MARCH				RAIN		WET				REAR END		PROPERTY. DAMAGE ONLY	1
APRIL		TUE.	1					DAWN OR DUSK		HEAD ON		FATAL	
MAY	1			SNOW		SNOWY				SIDE SWIPE			
JUNE		WED.						DARK LIGHTED		PARKED VEHICLE		INJURY	
JULY	1	THURS.	1									PROPERTY DAMAGE ONLY	
AUGUST				FOG		ICY	1			BACKING			
SEPT.		FRI.								FIXED OBJECT		1979 FATAL	
OCT.				OTHER		OTHER		DARK UN LIGHTED	1	NON COLLIS		INJURY	
NOV.		SAT.								ANIMAL		PROPERTY DAMAGE ONLY	2
DEC.													

The average accident severity at this site is $11,300.

The average yearly number of accidents is 1.00 accidents per year, with a yearly traffic volume of 0.241 million entering vehicles.

The accident rate calculates to be 4.15 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981 from 4:30 to 5:30 p.m.. A graphic summary of these counts is shown for convience in determining the various turning movements.

Using a peak hour evening factor of .076, the average daily traffic is:

North Leg	280 ADT
South Leg	300 ADT
West Leg	80 ADT

The capacity of this intersection for level of Service C operation is:

North Leg	590 VPH
South Leg	590 VPH
West Leg	140 VPH

The Volume/Capacity Ratio is:

$$V/C = \frac{660}{24\,(1320)} = .021$$

GRAPHIC SUMMARY OF VEHICLE MOVEMENTS

Intersection of COUNTY ROAD AND

And TURTLE LAKE ROAD

County LAKE

Site 5

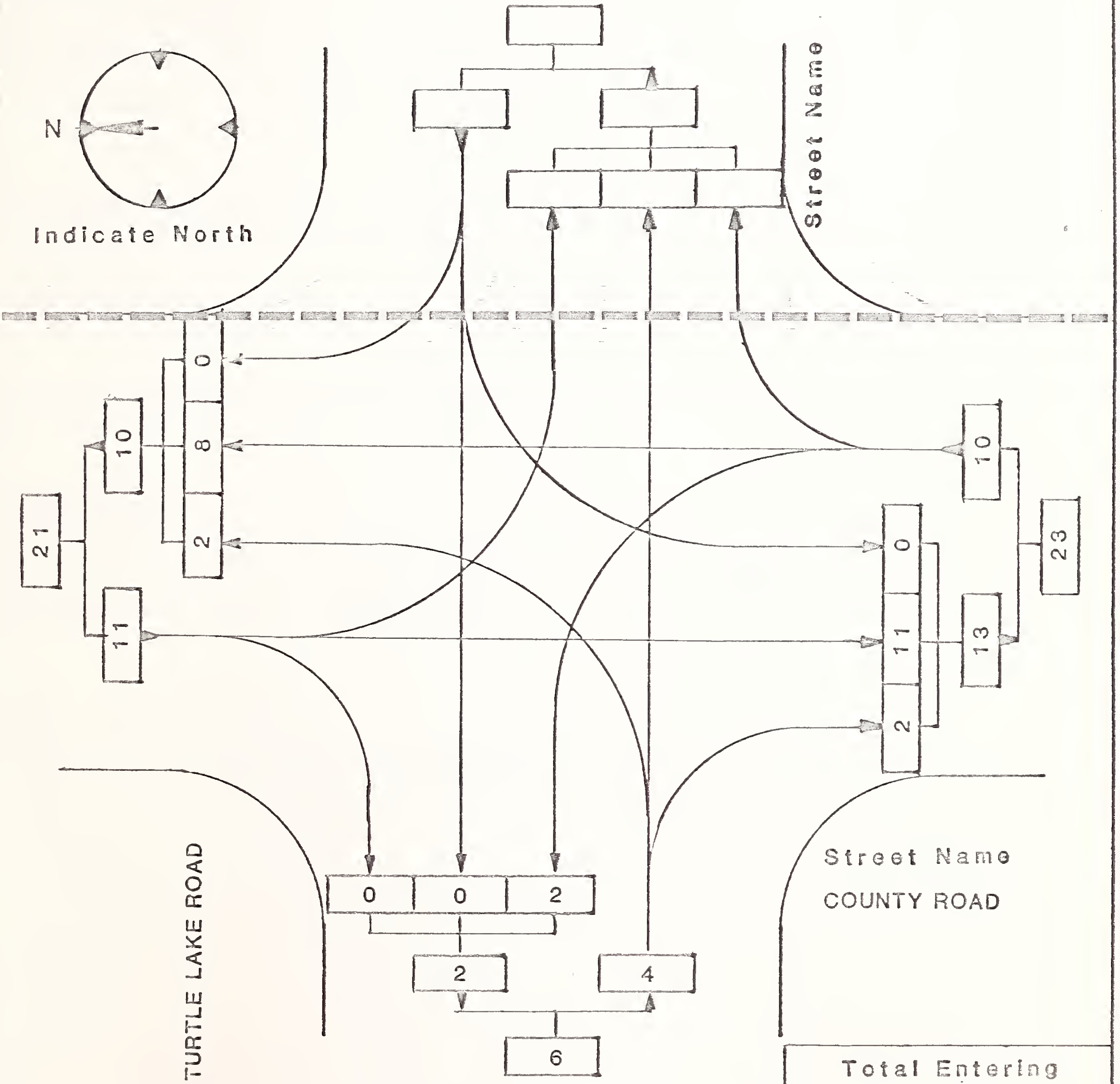
Observer

Date NOV. 24, 1981

DAY TUESDAY

Time a.m.

p.m. 4:30 TO 5:30



Total Entering		
	a.m.	p.m.
N/S		21
E/W		4
Total		25

NOTE: PEAK MAY BE LATER

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance from the west leg of this intersection along the north-south through road is 75 feet. The sight distance on the west leg to the intersection is greater than double the minimum Safe Stopping Sight Distance. Therefore, the 75 foot distance will be used as the existing sight distance. The minimum distance along the major road should be 400 feet at 30 mph. The ratio of existing to desirable is therefore, 75 divided by 400= 0.19.

The Driver Expectancy from the north is 2 from the south is 4, and from the west is 4, giving a weighted average of 4.00. (Highest is weighted twice, next highest once).

The Information System Defeciency from each direction is 3.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 5-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The Short Term Improvements recommended, will give priority to the north-south traffic. This is the road having the major traffic volumes.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #5 Date December 1981

Description County Road and Turtle Lake Road

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.00	acc/yr	21	x	0.145	=	3.045
Accident Rate	4.15	acc/MEV	72	x	0.199	=	14.328
Accident Severity	11,300	dollars	67	x	0.169	=	11.323
Volume/Capacity Ratio	.021		11	x	0.073	=	0.803
Sight Distance Ratio	0.19	(wt.avg.)	100	x	0.066	=	6.600
Driver Expectancy	4.00	(wt.avg.)	67	x	0.132	=	8.844
Info. System Deficiencies	3.00	(wt.avg.)	50	x	0.102	=	5.100
			SUMS:		0.886*		50.043

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{50.043}{0.886} = 56.482$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 5-1

The suggested improvements are:

1. Install stop sign on west leg of intersection.
2. Install stop ahead sign on west leg of intersection.
3. Install double head arrow sign for visability by the vehicles approaching the intersection from the west.
4. Install Tee intersection signs on the approaches from the north and south.

The improvements are shown on Figure 5-3.

TABLE 5-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Stop sign with post (30'' x 30'')	1	ea	180.00	180.00
Stop Ahead Sign with post (36'' x 36'')	1	ea	225.00	225.00
Double head arrow sign with post (48'' x 24'')	1	ea	210.00	210.00
T symbol sign with post (30'' x 30'')	2	ea	180.00	360.00
			Toal Cost	$ 975.00

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ENGINEERING
&
ASSOCIATES

1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO TRAFFIC HAZARD STUDY
PROJ. NO ______ BY ______
DATE ______ CK: ______
SITE #5

SHORT TERM IMPROVEMENTS

INTERSECTION OF COUNTY ROAD AND TURTLE LAKE ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M

WEST BOUND	10
EAST BOUND	13
SOUTH BOUND	2
	25 TOTAL

MIN. SIGHT DISTANCE 75'

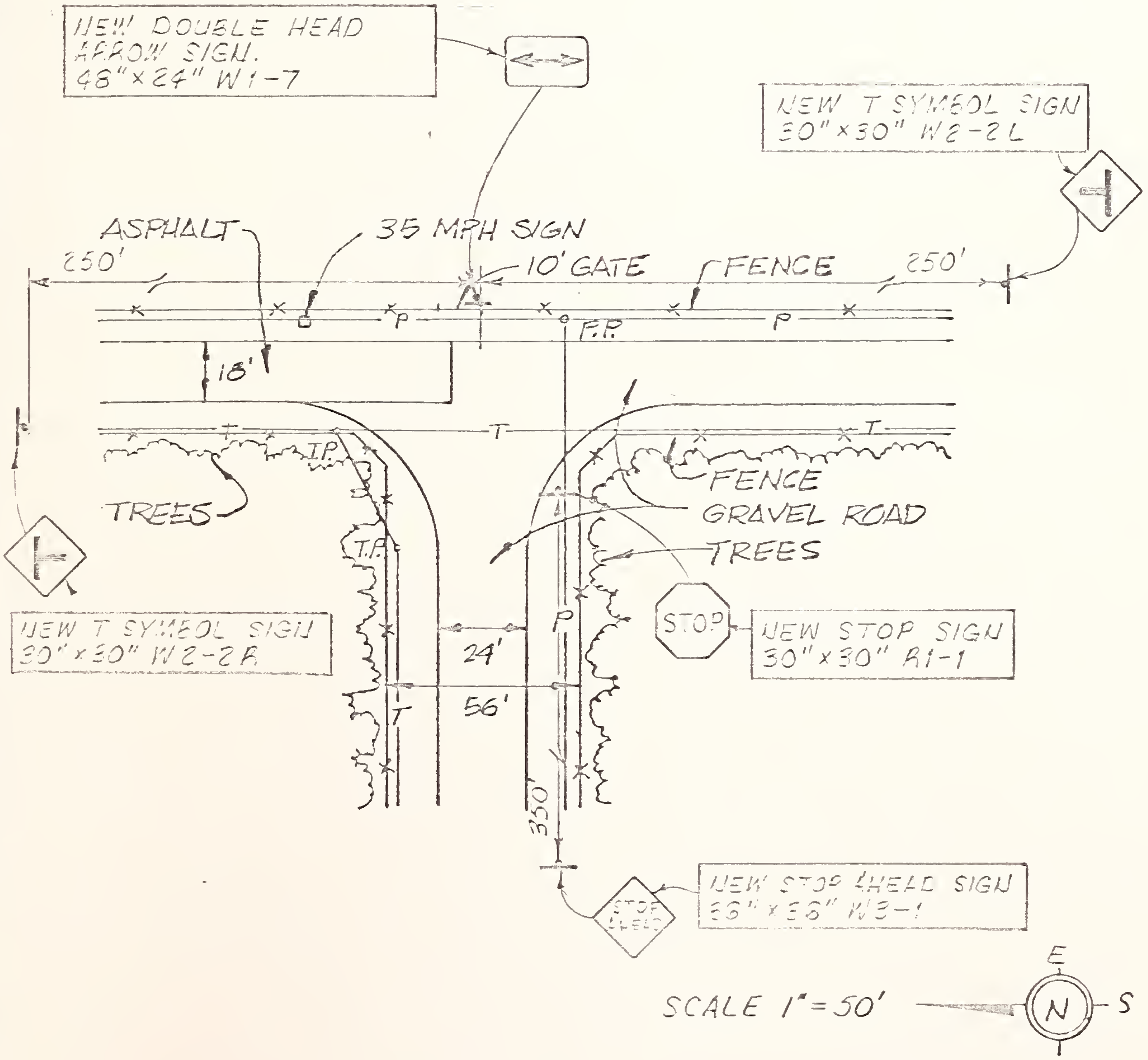
NEW DOUBLE HEAD ARROW SIGN. 48"×24" W1-7
NEW T SYMBOL SIGN 30"×30" W2-2L
ASPHALT
35 MPH SIGN
250'
10' GATE
FENCE
250'
P
P.P.
P
18'
T
T.P.
T
TREES
FENCE
GRAVEL ROAD
TREES
T.P.
NEW T SYMBOL SIGN 30"×30" W2-2R
P
24'
STOP
NEW STOP SIGN 30"×30" R1-1
56'
T
350'
STOP AHEAD
NEW STOP AHEAD SIGN 36"×36" W3-1
SCALE 1"=50'
E
N
S
W

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Figure 5-3

SITE 6

SITE # 6

FINLEY POINT ROAD AND NORTH FINLEY POINT ROAD

LOCATION AND EXISTING CONDITIONS

Site #6 is located on the Finley Point Road, about one mile off of Highway #35, to the northeast of Polson. The location is a Tee intersection.

The through north-south road has a 20 foot wide asphalt surface, and the west leg has a 24 foot wide asphalt surface.

Currently, the west to south movements through the intersection are facilitated with a super elevated curve. The super elevation is .07 feet per foot. However, there is a yield sign for the traffic entering from the west, giving a priority to the traffic from the north.

There is heavy tree cover on the northwest and southwest sides of the intersection, thus reducing visability.

Reference is made to Figure 6-1, which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

During the three year period, (1977 to 1979), there were three accidents at this site. From the collision diagram, Figure 6-2, and the Accident Summary Sheet, it is apparent that two of the accidents occured during snow cover conditions. There were ruts at the intersection, in addition to a high snow bank that restricted sight distances. These accidents were about one week apart, at mid-day.

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Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO ______ BY ______
DATE ______ CK ______
SITE #6

EXISTING CONDITION SKETCH

FINLEY POINT ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.

NORTH BOUND	12
SOUTH BOUND	6
WEST BOUND	11
	29 TOTAL

MIN. SIGHT DISTANCE	75'
SUPER ELEVATION	1.6' IN 22'

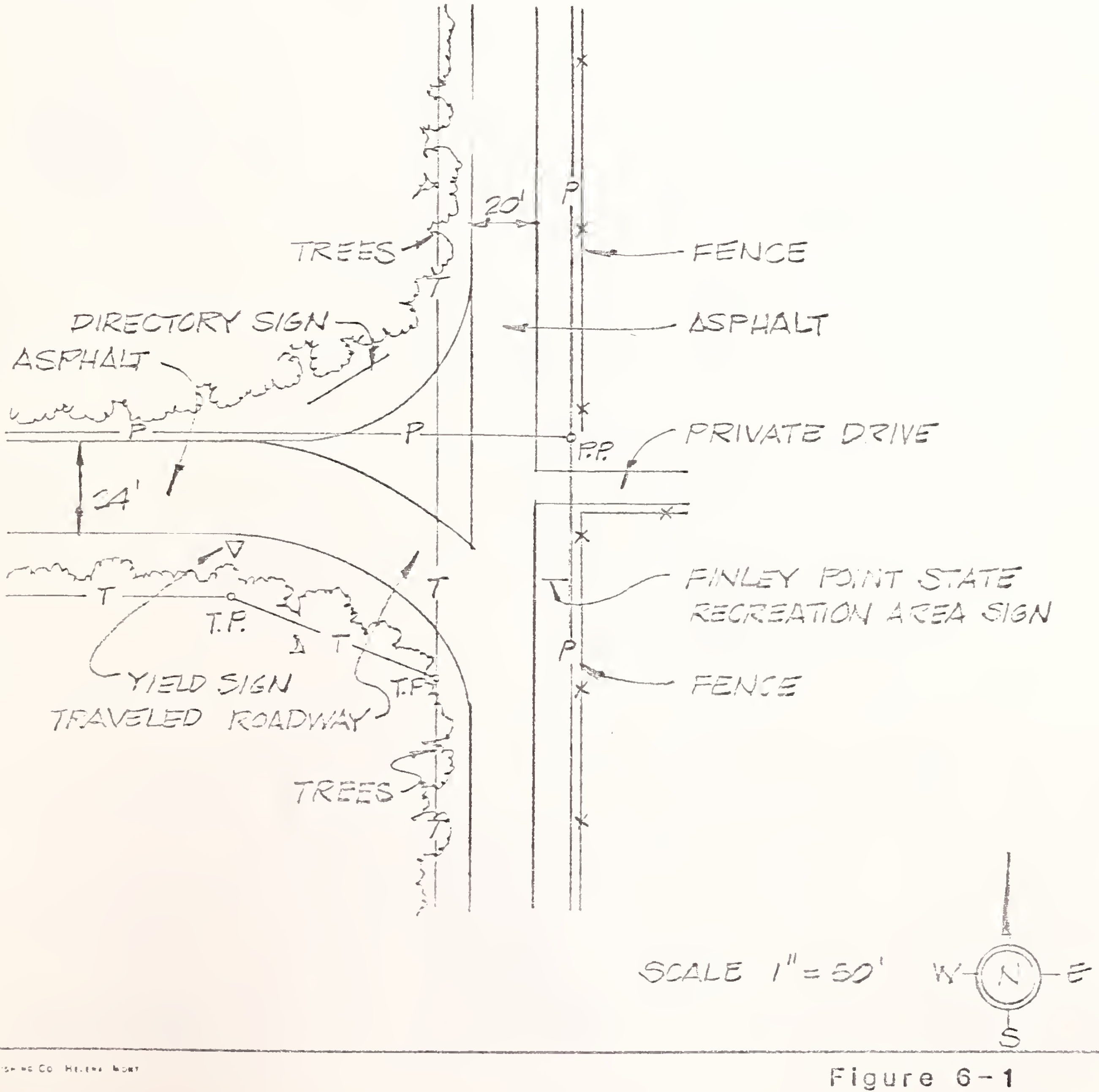

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Figure 6-1

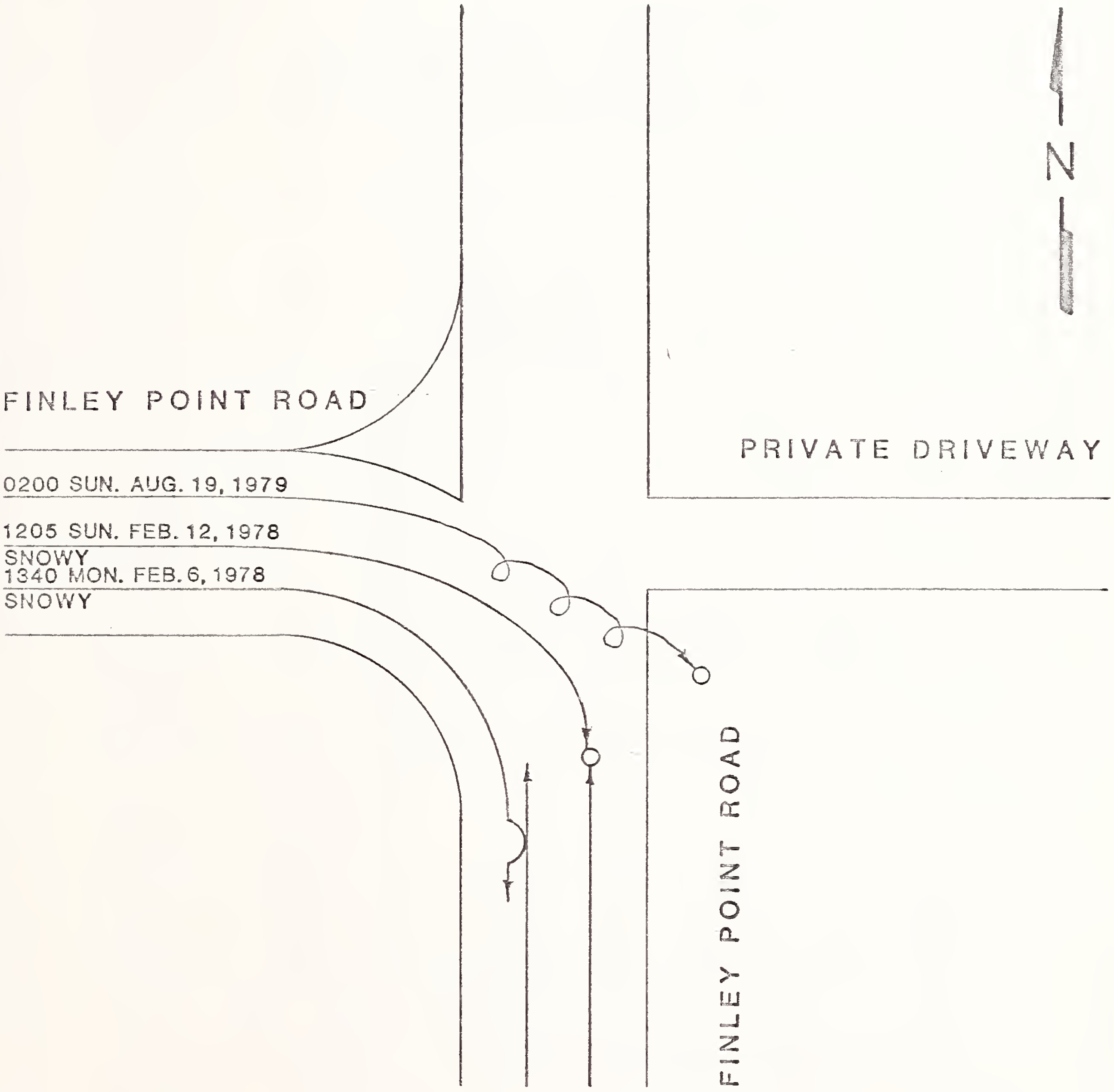
COLLISION DIAGRAM

SITE LOCATION FINLEY POINT ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 6



0200 SUN. AUG. 19, 1979

1205 SUN. FEB. 12, 1978
SNOWY

1340 MON. FEB. 6, 1978
SNOWY

NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
2 PROPERTY DAMAGE ONLY 1 INJURY OR FATAL 3 TOTAL ACCIDENTS	←—— MOVING VEHICLE ←<<<— BACKING VEHICLE ← — NON-INVOLVED VEHICLE ×— — — PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 6-2

ACCIDENT SUMMARY

SITE NUMBER 6 LOCATION FINLEY POINT ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.	2	CLEAR	3	DRY	1	Day	2	ANGLE		FATAL	
FEB.	2									LEFT TURN		INJURY	
MARCH		MON.	1							REAR END		PROPERTY. DAMAGE ONLY	
APRIL				RAIN		WET		DAWN OR DUSK		HEAD ON	1	1978 FATAL	
MAY		TUE.								SIDE SWIPE	1	INJURY	1
JUNE		WED.		SNOW		SNOWY	2			PARKED VEHICLE		PROPERTY DAMAGE ONLY	1
JULY								DARK LIGHTED		BACKING		1979 FATAL	
AUGUST	1	THURS.								FIXED OBJECT		INJURY	1
SEPT.				FOG		ICY				NON COLLIS	1	PROPERTY DAMAGE ONLY	
OCT.		FRI.								ANIMAL			
NOV.				OTHER		OTHER		DARK UN LIGHTED	1				
DEC.		SAT.											

The third accident occured late at night, and was a single vehicle accident. The vehicle went straight at the Tee intersection, instead of turning.

The average accident severity at this site is $13,700.

The average yearly number of accidents is 1.00 accidents per year, with a yearly traffic volume of 0.139 million entering vehicles.

The accident rate calculates to be 7.19 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981 from 4:30 to 5:30 p.m.. A Graphic Summary of these counts is shown for convience in determining the various turning movements. Using a peak hour evening factor of .076 the average daily traffic is: *

North Leg	220 ADT
South Leg	380 ADT
West Leg	160 ADT

The capacity of this intersection for level of Service C operation is:

North Leg	460 VPH
South Leg	380 VPH
West Leg	160 VPH

The Volume/Capacity Ratio is:

$$V/C = \frac{760}{24\ (1130)} = 0.028$$

---

* The concept of a seasonal adjustment because of recreational traffic was considered. However, it was not altered, since this location is already the number one priority.

GRAPHIC SUMMARY OF VEHICLE MOVEMENTS

Intersection of FINLEY POINT ROAD

And NORTH FINLEY POINT ROAD AND PRIVATE DRIVE

County LAKE

Site 6

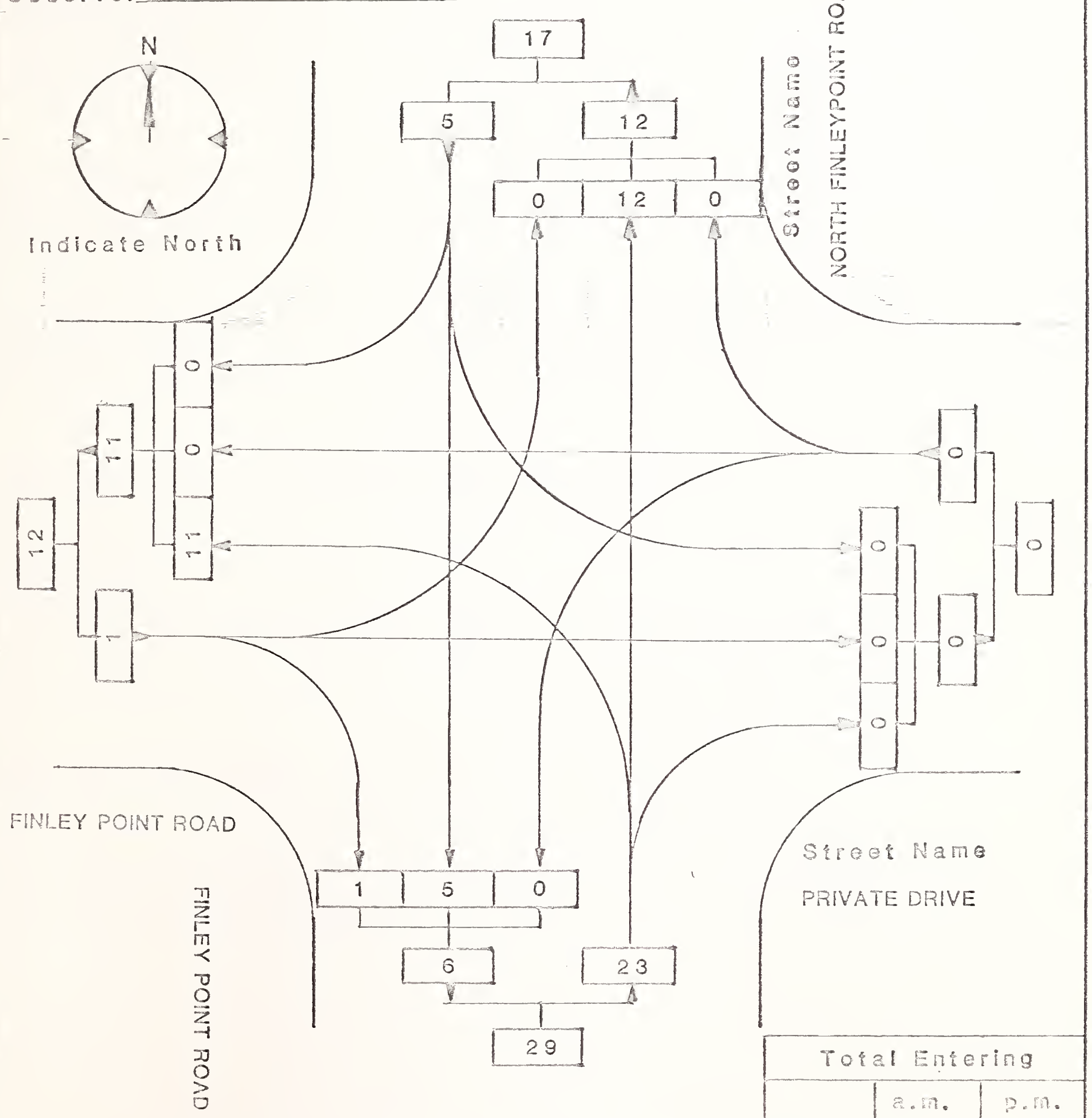
Observer

Date NOV. 24, 1981

DAY TUESDAY

Time a.m.

p.m. 4:30 TO 5:30



NOTE: PEAK MAY BE LATER

Total Entering		
	a.m.	p.m.
N/S		28
E/W		1
Total		29

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance from the west leg of this intersection along the north-south through road is 75 feet. The sight distance on the west leg to the yield sign is greater than double the minimum Safe Stopping Sight Distance. Therefore, the 75 foot distance will be used as the existing sight distance.

The minimum distance along the major road should be 400 feet at 30 MPH. The ratio of existing to desirable is 75 divided by 400 = 0.19.

The Driver Expectancy from all three directions is 4; giving a weighted average of 4.00 (highest is weighted twice, next highest once).

The Information System Deficiency from each direction is 5.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 6-1) indicates the indices and analysis parameters derived from the data collection effects.

SHORT TERM IMPROVEMENTS

The short term improvements recommended will provide better signing, and create a stop condition for the west leg of the intersection. Sight distances will also be improved.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #6

Date December 1981

Description Finley Point Road and North Finley Point Road

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.00	acc/yr	21	x	0.145	=	3.045
Accident Rate	7.19	acc/MEV	100	x	0.199	=	19.900
Accident Severity	13,700	dollars	73	x	0.169	=	12.337
Volume/Capacity Ratio	0.028		13	x	0.073	=	.949
Sight Distance Ratio	0.19	(wt.avg.)	100	x	0.066	=	6.600
Driver Expectancy	4.00	(wt.avg.)	67	x	0.132	=	8.844
Info. System Deficiencies	5.00	(wt.avg.)	83	x	0.102	=	8.466
			SUMS:		0.886*		60.141

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{60.141}{0.886} = 67.879$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 6-1

The recommended improvements are:

1. Replace existing yield sign with a stop sign on the west leg, and painted stop bar.
2. Install stop ahead sign.
3. Relocate the Finley Point State Recreation Area sign to the south.
4. Install new double head arrow sign for the west leg.
5. Install new T symbol sign on the north leg.
6. Cut trees and brush on the northwest corner to improve sight distances.

These improvements are shown on Figure 6-3.

TABLE 6-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Stop sign with post (30" x 30")	1	ea	180.00	180.00
Stop ahead Sign with post (36" x 36")	1	ea	225.00	225.00
Relocate Rec. Sign	1	ea	200.00	200.00
Double head arrow sign with post	1	ea	210.00	210.00
T Symbol sign with post (30" x 30")	1	ea	180.00	180.00
Clear trees and brush	1	Lump Sum		500.00
Painted Stop Bar	1	Lump Sum		100.00
			Total Cost	$ 1,595.00

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BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ______ BY: ______
DATE ______ CK: ______
SITE #6

SHORT TERM IMPROVEMENTS

FINLEY POINT ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.

NORTH BOUND	12
SOUTH BOUND	6
WEST BOUND	11
	29 TOTAL

MIN. SIGHT DISTANCE	75'
SUPER ELEVATION	1.6' IN 22'

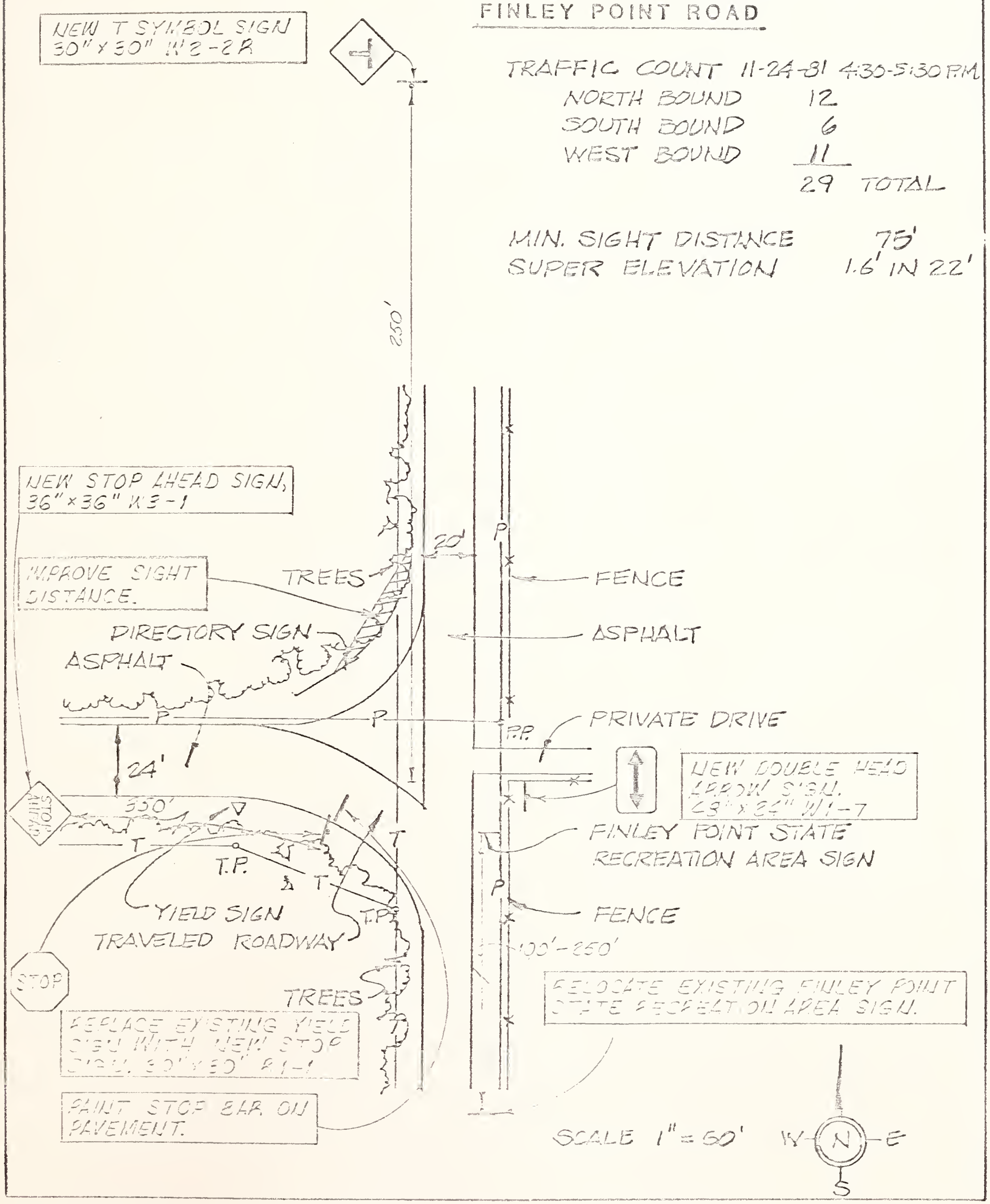
NEW T SYMBOL SIGN 30"x30" W2-2R
250'
NEW STOP AHEAD SIGN, 36"x36" W3-1
IMPROVE SIGHT DISTANCE.
TREES
20'
P
FENCE
DIRECTORY SIGN
ASPHALT
ASPHALT
P
P
P.P.
PRIVATE DRIVE
24'
NEW DOUBLE HEAD ARROW SIGN, 48"x24" W1-7
350'
STOP AHEAD
T
T.P.
T
T
T.P.
FINLEY POINT STATE RECREATION AREA SIGN
P
FENCE
YIELD SIGN
TRAVELED ROADWAY
100'-250'
STOP
TREES
REPLACE EXISTING YIELD SIGN WITH NEW STOP SIGN, 30"x30" R1-1
RELOCATE EXISTING FINLEY POINT STATE RECREATION AREA SIGN.
PAINT STOP BAR ON PAVEMENT.
SCALE 1" = 60'
N
W
E
S

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Figure 6-3

SITE 7

SITE # 7

THERESA ADAMS S.E. OF ARLEE

LOCATION AND EXISTING CONDITIONS

Site #7 is located southeast of Arlee on the Theresa Adams Road. The hazardous section of road begins about one quarter of a mile north of an intersection, and continues, downgrade, to the Jocko River Bridge

The most serious spot in this section of road is the first sharp curve north of the intersection. The road is fifteen to twenty feet wide, with a gravel surface. When traveling to the north, the sharp curve occurs at the same location as the beginning of an 8% downgrade around the curve. After the curve, the grade flattens to a 3% downgrade.

The degree of curvature of the curve is 42°, with a super elevation of 0.08 ft. per foot. This relates to a design speed of approximately 20 mph.

At the northern end of this section of road (the Jocko River Crossing), the downgrade is up to 13%, when entering a right hand curve. This curve has a degree curvation of 33°, with a super elevation of approximately 0.08 ft per foot. This relates to a design speed of 20 mph.

Reference is made to Figure 7-1 and 7A-1, which is the Existing Condition Sketches.

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO. ____ BY: ____
DATE ____ CK: ____
SITE # 7

EXISTING CONDITION SKETCH

THERESA ADAMS ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.

NORTH BOUND	4
SOUTH BOUND	3
	7 TOTAL

MIN. SIGHT DISTANCE 80'
SUPER ELEVATION 1.1' IN 13'
DEGREE OF CURVE 42°

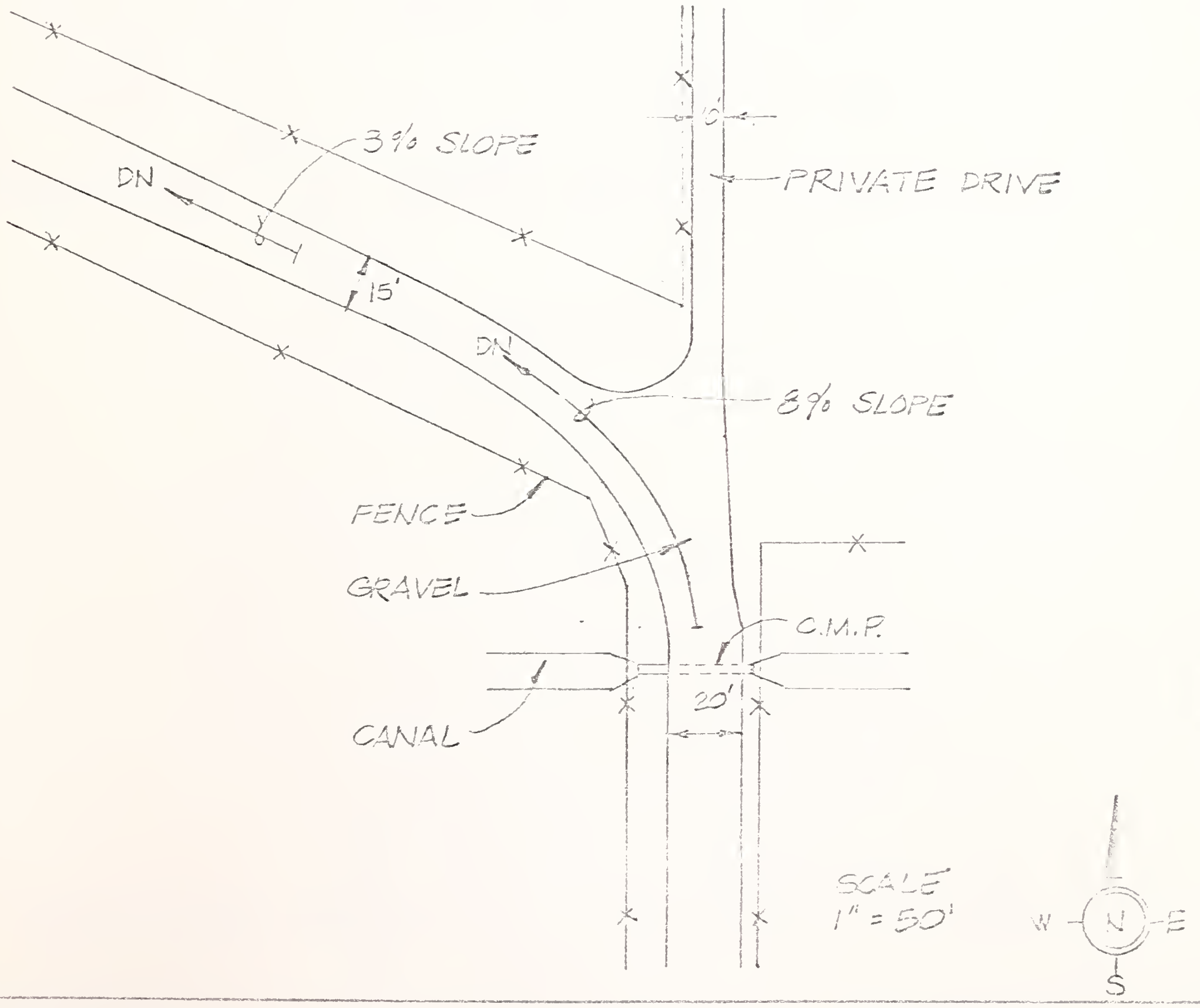

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Figure 7-1

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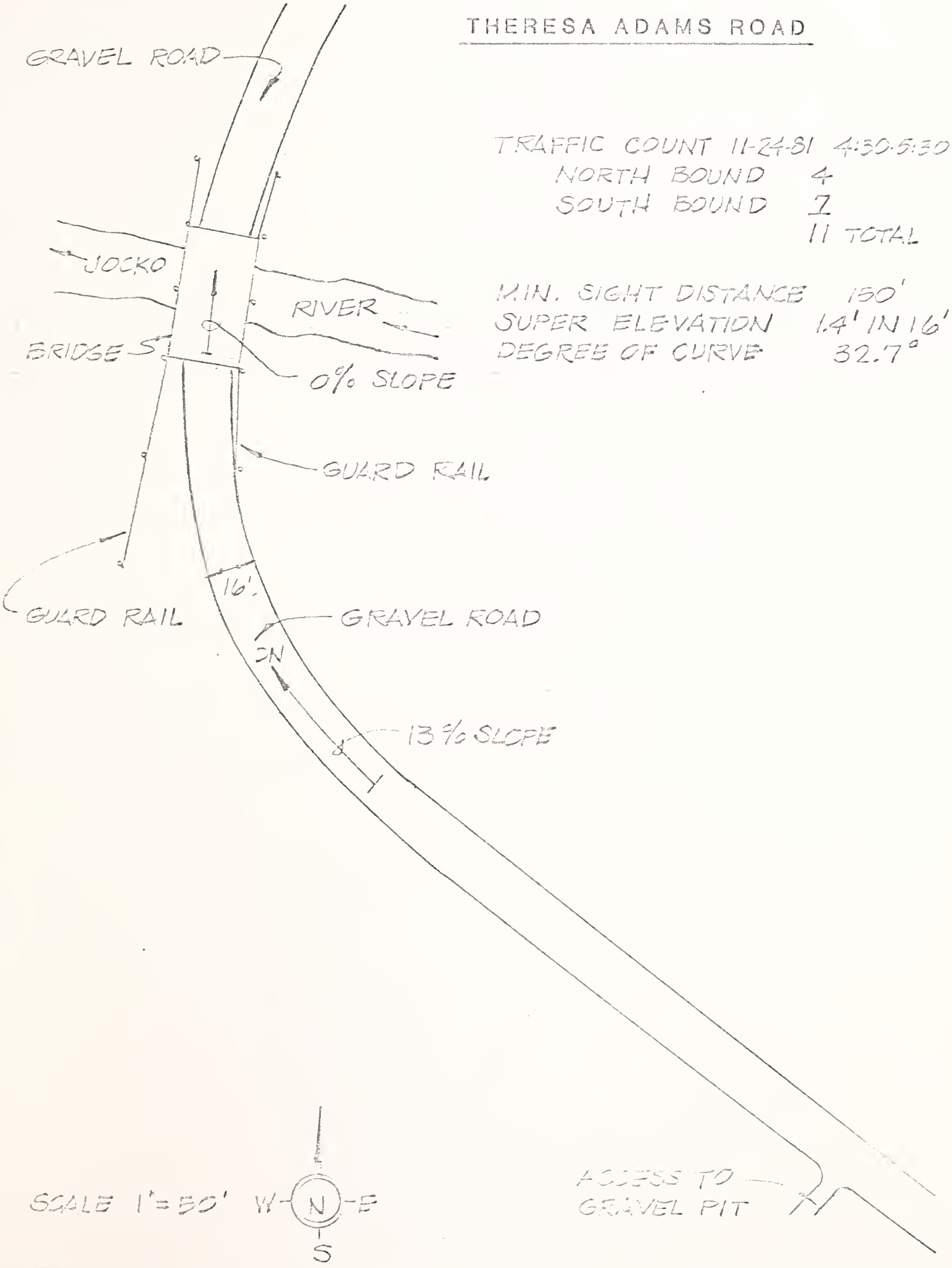
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO. ________ BY: ________
DATE ________ CK: ________
SITE # 7A

EXISTING CONDITION SKETCH

THERESA ADAMS ROAD



TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.
NORTH BOUND 4
SOUTH BOUND 7
11 TOTAL

MIN. SIGHT DISTANCE 150'
SUPER ELEVATION 1.4' IN 16'
DEGREE OF CURVE 32.7°

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Figure 7A-1

ACCIDENT ANALYSIS

During the three year period, (1977 to 1979), there were two recorded accidents on this section of the Theresa Adams Road. One accident occured at the southerly curve on the road. This is also the first curve when driving north. It was a single vehicle accident, caused by the vehicle going out of control on the curve. The accident report also indicated this section of roadway was in a washboard condition. There have been two other similar accidents on this curve, however, these did not occur within the three year time period of this study.

The other accident took place at the bridge over the Jocko River. This location is at the northerly end of this study section of roadway. Shown on the Collision Diagram, Figure 7-2, the vehicle failed to negotiate the curve prior to the bridge,thereby striking the bridge railing. Reportedly, this accident was caused when the engine quit, making the power steering inoperative.

The average accident severity at this site is $10,800.

The average yearly number of accidents is 0.67 accidents per year, with a yearly traffic volume of 0.033 million vehicles.

The accident rate calculates to be 20.00 accidents per million entering vehicles (MEV).

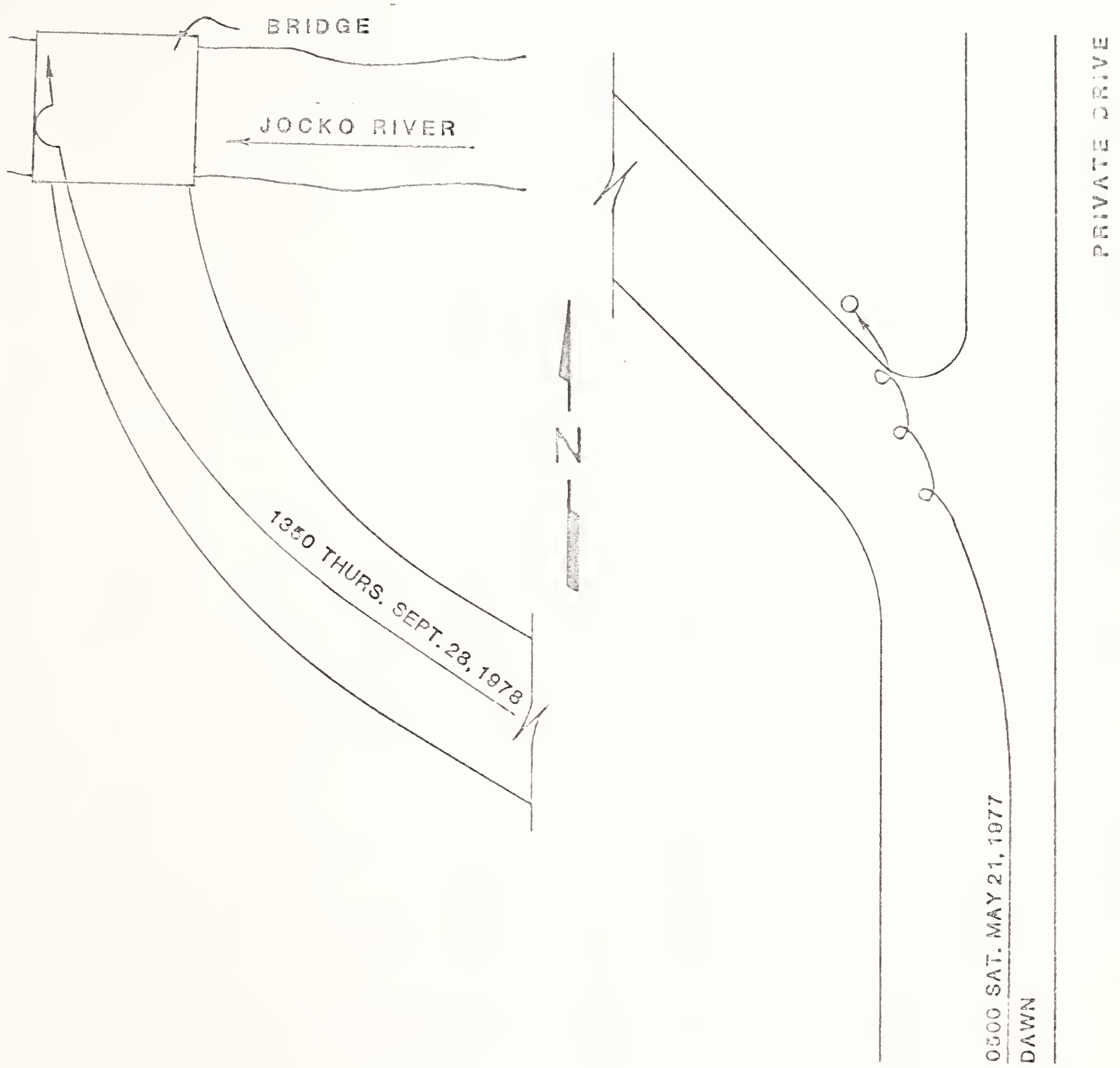
COLLISION DIAGRAM

SITE LOCATION THERESA ADAMS ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 7



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
1 PROPERTY DAMAGE ONLY 1 INJURY OR FATAL 2 TOTAL ACCIDENTS	← MOVING VEHICLE BACKING VEHICLE ← — NON-INVOLVED VEHICLE X— — — PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 7-2

ACCIDENT SUMMARY

SITE NUMBER 7 LOCATION THERESA ADAMS ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.		CLEAR	2	DRY	2	Day	1	ANGLE		1977 FATAL	
FEB.		MON.		RAIN		WET		DAWN OR DUSK	1	LEFT TURN		INJURY	1
MARCH		TUE.		SNOW		SNOWY		DARK LIGHTED		REAR END		PROPERTY. DAMAGE ONLY	
APRIL		WED.	1	FOG		ICY		DARK UN LIGHTED		HEAD ON		1978 FATAL	
MAY	1	THURS.		OTHER		OTHER				SIDE SWIPE		INJURY	
JUNE		FRI.								PARKED VEHICLE		PROPERTY DAMAGE ONLY	1
JULY		SAT.	1							BACKING		FATAL	
AUGUST	1									FIXED OBJECT	1	INJURY	
SEPT.										NON COLLIS	1	PROPERTY DAMAGE ONLY	
OCT.										ANIMAL			
NOV.													
DEC.													

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981 from 4:30 to 5:30 p.m.. The total peak hour traffic was 7. Using a peak hour evening factor of 0.076, the average daily traffic computes to be 90 vehicles.

The capacity of the roadway for level of Service C operation is 137 vehicles per hour.

The Volume/Capacity Ratio is:

$$V/C = \frac{90}{24\ (137)} = 0.027$$

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance on the southerly curve is 80 feet from both directions. The curve at the bridge has a sight distance of 150 feet. However, since the two lowest sight distances are used to determine a weighted average, the 80 foot distance will be used. The minimum Safe Stopping Sight Distance is 200 feet at 30 mph. Therefore, the ratio of existing to desirable is 80 divided by 200 = 0.40.

The Driver Expectancy for the southerly curve, is 4 from the south and 2 from the northwest. The southwesterly approach to the curve at the bridge has a Driver Expectancy of 2. The weighted average is 3.33. (Highest is weighted twice, next highest, once).

The Information System Deficiency for the southerly curve is 5 from the south and 3 from the northwest. The southeasterly approach to the curve at the bridge has a driver expectancy of 3. The weighted average is 4.33.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 7-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The short term improvements to be recommended, will give better signing at both ends of this section of roadway. The recommended improvements are:

1. Install turn signs with 20 mph speed advisory plates on each approach to the southerly curve.
2. Install new large signs at the southerly curve, and at the curve prior to the Jocko River Bridge.

Further improvements, such as improving the geometrics of the roadway do not appear to be warranted with such low traffic volumes. The improvements are shown on Figure 7-3 and 7A-3.

TABLE 7-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Turn sign with post (30''x30'')	2	ea	180.00	360.00
20 mph speed advisory plate (18'' x 18'')	2	ea	35.00	70.00
Large arrow sign with post (48'' x 24'')	2	ea	210.00	420.00
			Total Cost	$850.00

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #7 Date December 1981

Description Theresa Adams (near Jocko River) S.E. of Arlee

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	0.67	acc/yr	12	x	0.145	=	1.740
Accident Rate	20.00	acc/MEV	100	x	0.199	=	19.900
Accident Severity	10,800	dollars	66	x	0.169	=	11.154
Volume/Capacity Ratio	.027		12	x	0.073	=	0.876
Sight Distance Ratio	0.40	(wt.avg.)	100	x	0.066	=	6.600
Driver Expectancy	3.33	(wt.avg.)	56	x	0.132	=	7.392
Info. System Deficiencies	4.33	(wt.avg.)	72	x	0.102	=	7.344
			SUMS:		0.886*		55.006

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{55.006}{0.886} = 62.084$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 7-1

TITLE *LAKE CO. TRAFFIC HAZARD STUDY*
PROJ NO ______ BY: ______
DATE ______ CK: ______
SITE # 7

SHORT TERM IMPROVEMENTS

THERESA ADAMS ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.
NORTH BOUND 4
SOUTH BOUND 3
7 TOTAL

MIN. SIGHT DISTANCE 80'
SUPER ELEVATION 1.1" IN 13'
DEGREE OF CURVE 42°

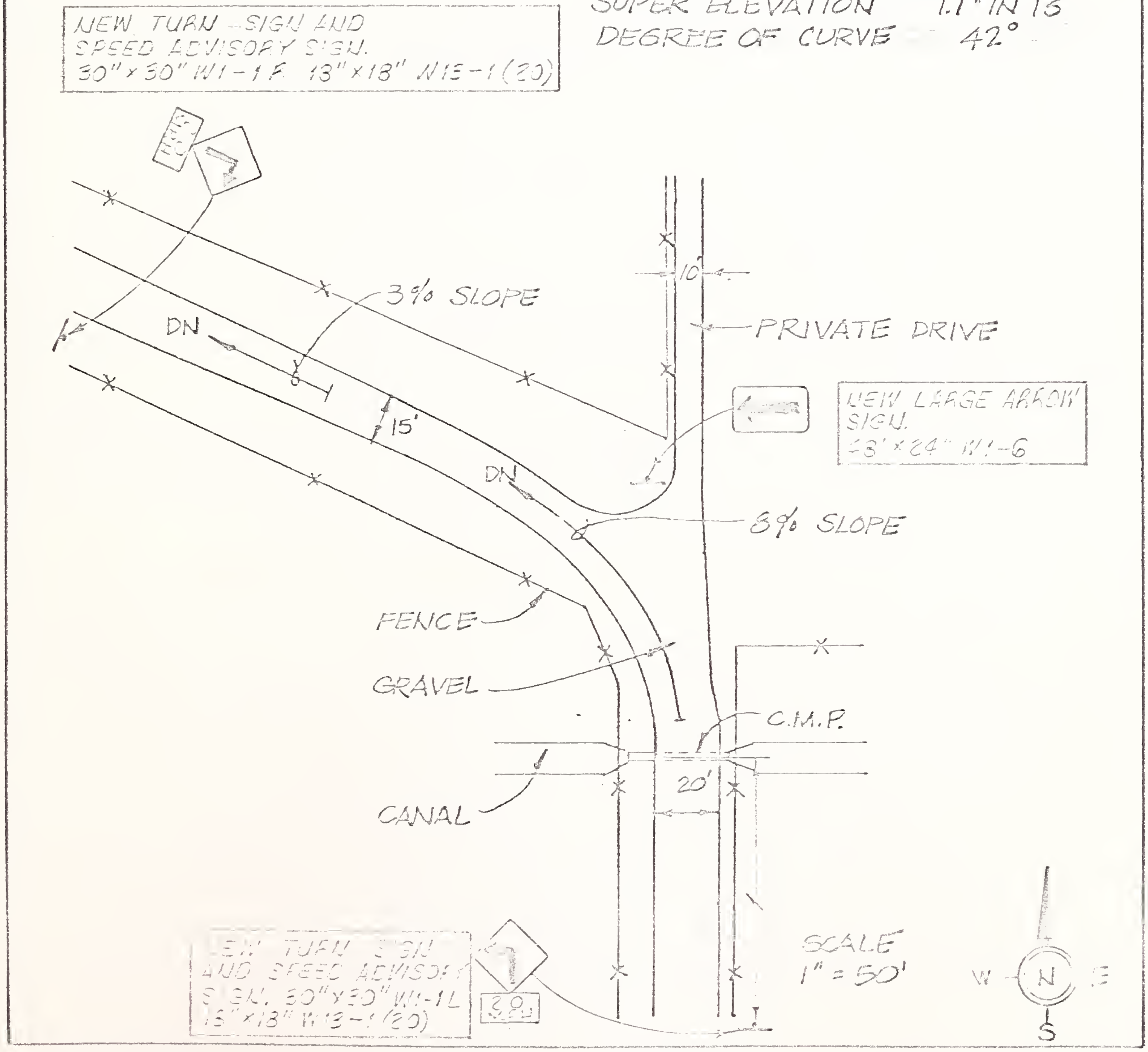


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Figure 7-3

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BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO. ________ BY ________
DATE ________ CK: ________
SITE # 7A

SHORT TERM IMPROVEMENTS

THERESA ADAMS ROAD

TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.
NORTH BOUND 4
SOUTH BOUND 7
11 TOTAL

MIN. SIGHT DISTANCE 150'
SUPER ELEVATION 1.4' IN 16'
DEGREE OF CURVE 32.7°

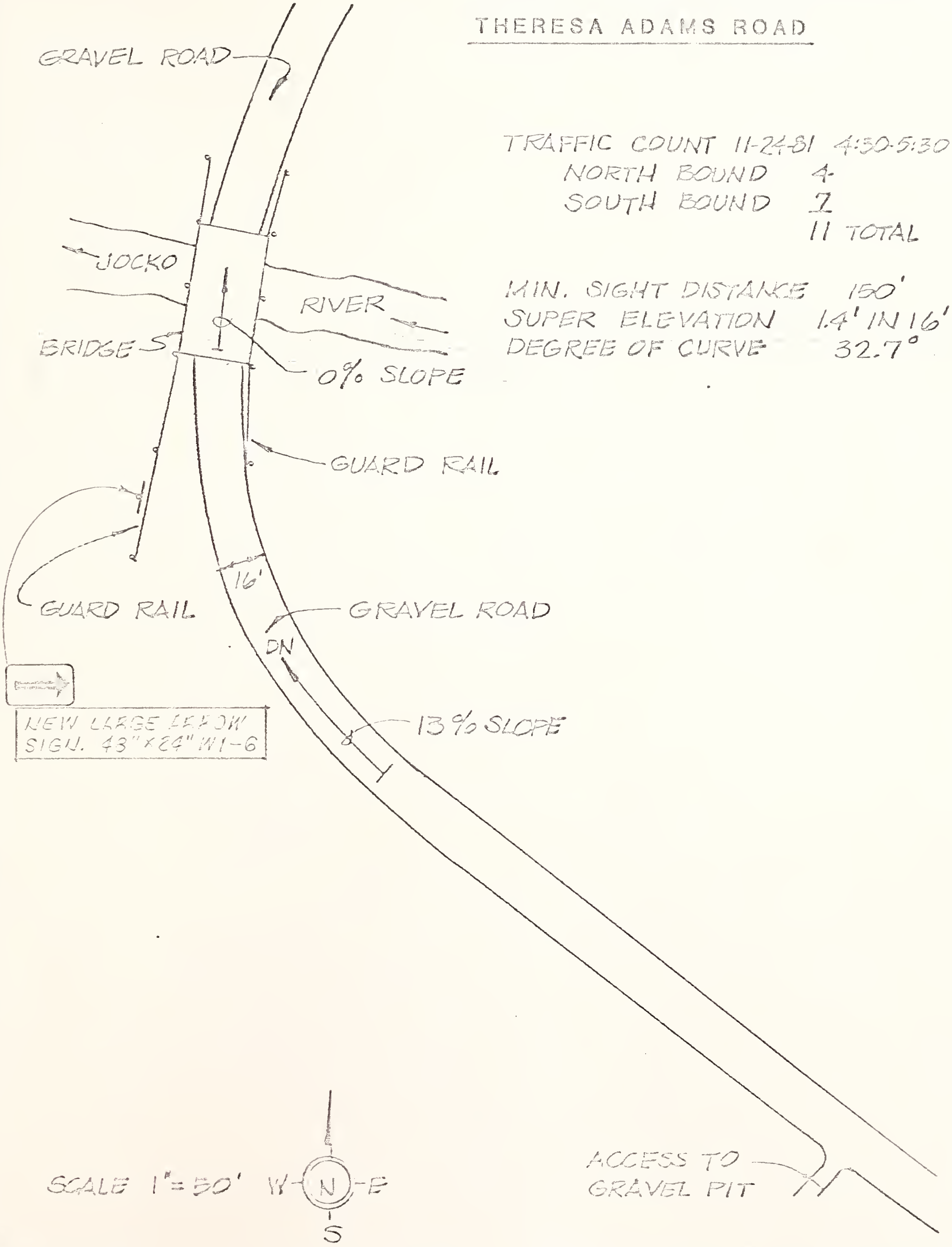

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Figure 7A-3

SITE 8

SITE # 8

County Road N.W. of St. Ignatius

LOCATION AND EXISTING CONDITIONS

Site #8 is located northwest of St. Ignatius. It is four miles north and then four miles west of Highway #93.

This location is a curve on the main road. While traveling to the west, a straight road exists for four miles prior to the curve.

The degree of curvature of the curve is 32°, with virtually no super elevation. This relates to a design speed of 17 mph. Also, beginning with the curve, is a downslope of 7%. The outside of the curve is a steep embankment.

The roadway is approximately 18 feet wide with asphalt surfacing from the curve east, and gravel surfacing from the curve west. There is a short section of guardrail, in the area of the steep embankment. There is also an existing curve sign about 420 feet to the east of the curve.

Reference is made to Figure 8-1 which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

During the three year period, (1977 to 1979), there were five recorded accidents on this section of roadway. The Collision Diagram, Figure 8-2, indicates the types of accidents, and the Accident Summary Sheet shows different conditions that existed at the time of the accidents.

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BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO ______ BY ______
DATE ______ CK: ______
SITE #6

EXISTING CONDITION SKETCH

COUNTY ROAD

TRAFFIC COUNT 11-24-81 7:30-8:30 AM

EAST BOUND	6
WEST BOUND	3
SOUTH BOUND	1
	10 TOTAL

MIN. SIGHT DISTANCE 100'
SUPER ELEVATION .1" IN 18'
DEGREE OF CURVE 31.8°

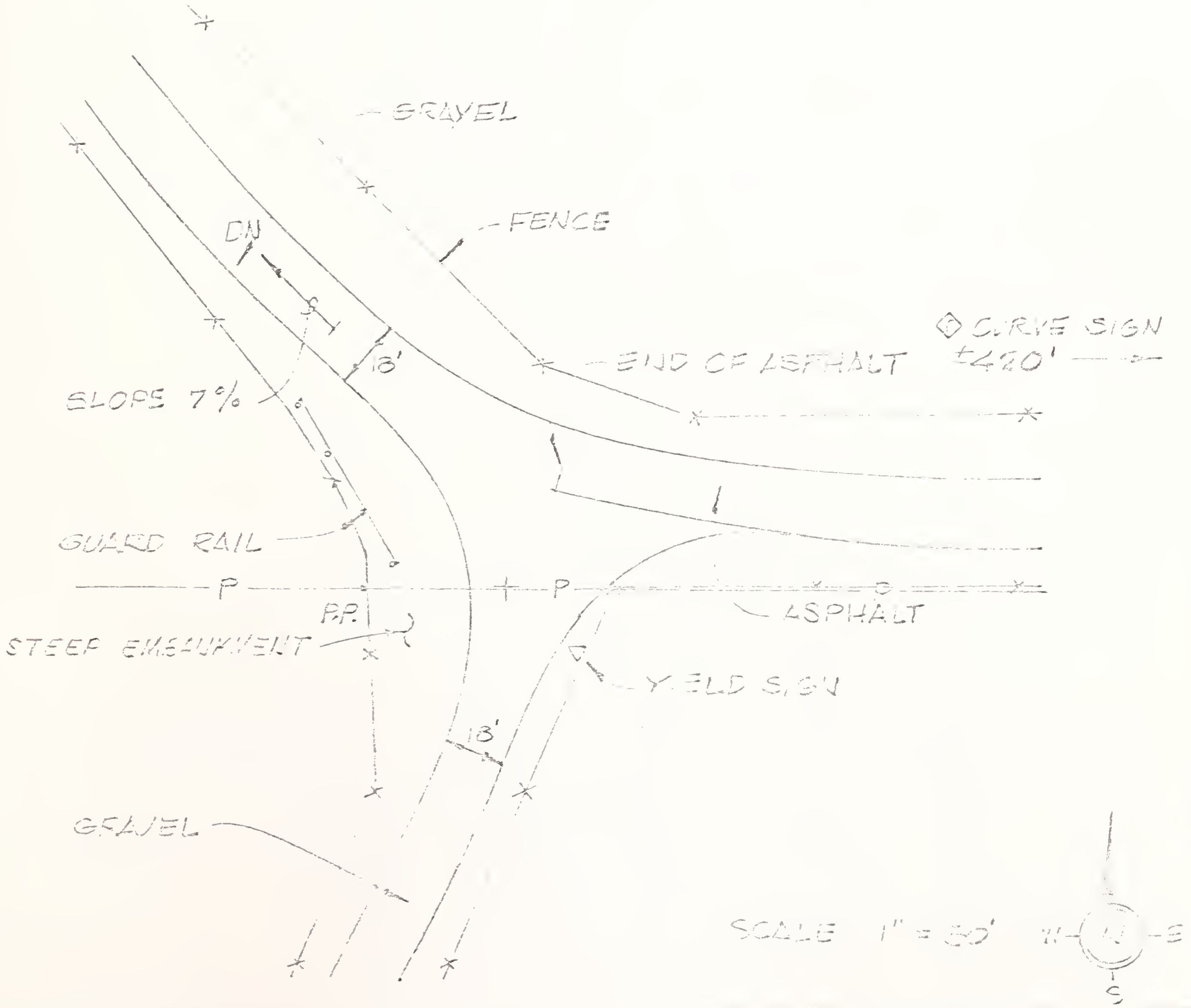


Figure 8-1

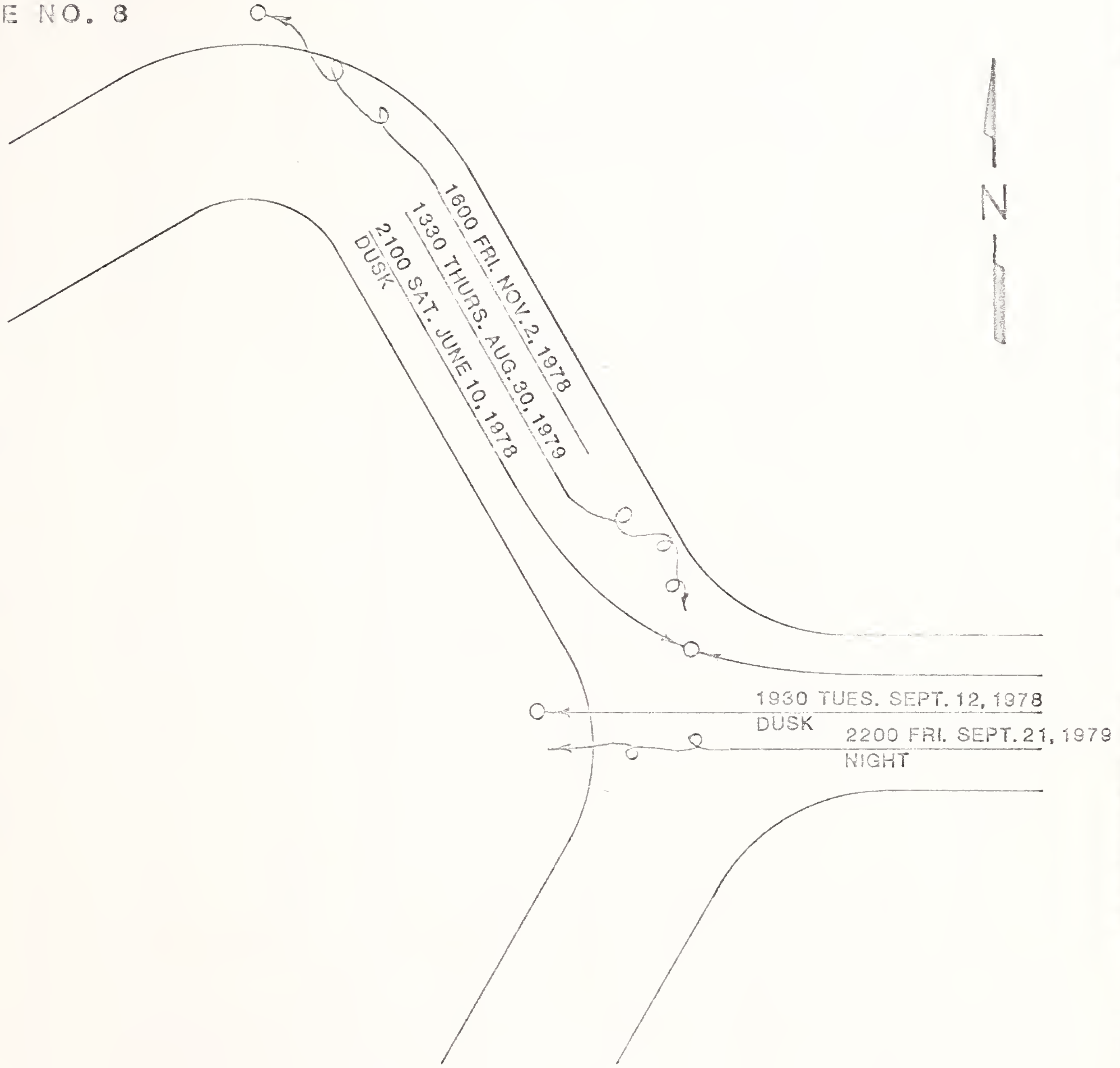
COLLISION DIAGRAM

SITE LOCATION COUNTY ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 8



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
2 PROPERTY DAMAGE ONLY 3 INJURY OR FATAL 5 TOTAL ACCIDENTS	MOVING VEHICLE BACKING VEHICLE NON-INVOLVED VEHICLE PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 8-2

ACCIDENT SUMMARY

SITE NUMBER 8 LOCATION COUNTY ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.		CLEAR	5	DRY	5	Day	2	ANGLE		FATAL	
FEB.		MON.		RAIN		WET		DAWN OR DUSK	2	LEFT TURN		INJURY	
MARCH		TUE.	1	SNOW		SNOWY		DARK LIGHTED		REAR END		PROPERTY. DAMAGE ONLY	
APRIL		WED.		FOG		ICY		DARK UN LIGHTED	1	HEAD ON	1	1978 FATAL	
MAY		THURS.	2	OTHER		OTHER				SIDE SWIPE		INJURY	3
JUNE	1	FRI.								PARKED VEHICLE		PROPERTY DAMAGE ONLY	
JULY		SAT.	2							BACKING		1979 FATAL	
AUGUST	1									FIXED OBJECT		INJURY	
SEPT.	2									NON COLLIS	4	PROPERTY DAMAGE ONLY	2
OCT.										ANIMAL			
NOV.	1												
DEC.													

As shown, three of the accidents occured at the first curve when traveling to the west. Two of these were single vehicle accidents, where the vehicles went over the embankment after failing to negotiate the curve. The other accident on the curve involved two vehicles hitting head-on. The remaining two accidents occured within the curvy section of roadway. Both were single vehicle accidents, and involved speeds which were too fast for the condition of the roadway. The average accident severity at this site is $13,240.

The average yearly number of accidents is 1.67 accidents per year, with a yearly traffic volume of 0.065 million vehicles.

The accident rate calculates to be 25.69 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981 from 7:30 to 8:30 a.m.. The total peak hour traffic was factored using a morning factor of 0.056. This resulted in an average daily traffic of 160 ADT.

The capacity of the roadway for level of Service C operation is 110 vehicles per hour. The Volume/Capacity Ratio is:

$$V/C = \frac{160}{24}(110) = 0.061$$

GRAPHIC SUMMARY OF VEHICLE MOVEMENTS

Intersection of CURVE ON COUNTY ROAD

And

County LAKE

Site 8

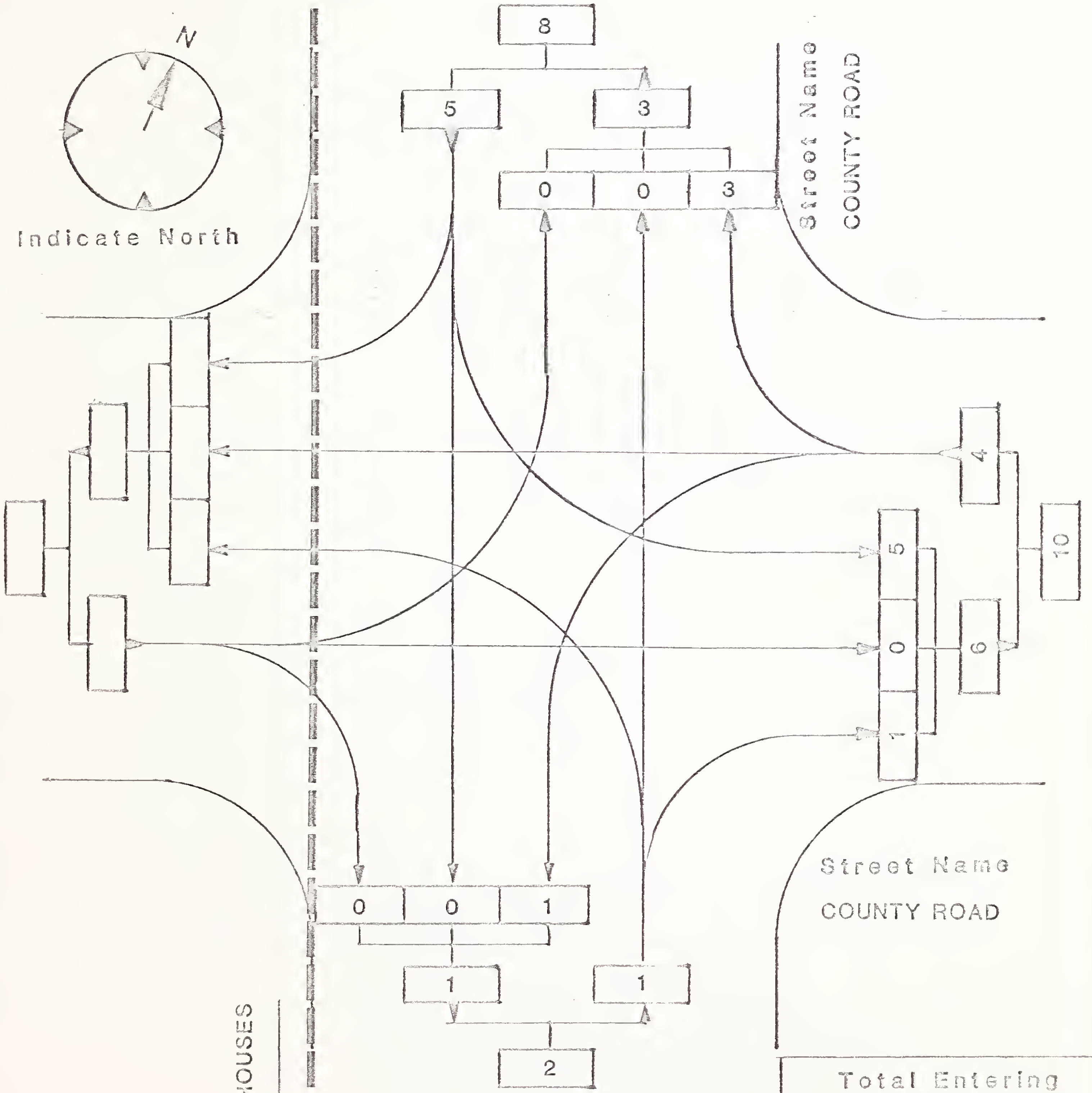
Observer

Date NOV. 24, 1981

DAY TUESDAY

Time a.m. 7:30 TO 8:30

p.m.



TO TWO HOUSES

Total Entering		
	a.m.	p.m.
N/S	6	
E/W	4	
Total	10	

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing sight distance at this curve is 100 feet. The minimum Safe Stopping Sight Distance is 200 feet at 30 mph. Therefore, the ratio of existing to desirable is 100 divided by 200 = 0.5.

The driver expectancy is 2 from the west, and 4 from the east giving a weighted average of 3.33. (Highest is weighted twice, next highest, once).

The Information System Deficiency from the west is 3, and the east is 4, giving a weighted average of 3.67.

HAZARD INDEX

The Hazard Index Computation sheet (Table 8-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The short term improvements to be recommended will provide signing to make the driver more aware of an approaching curve. This is necessary, since prior to the curve, a long section of straight roadway exists.

The recommended improvements are:

1. Remove curve sign and install turn sign with a 15 mph speed advisory plate.
2. Install 4 chevron alignment signs at the curve.

The recommended improvements are shown on Figure 8-3.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #8 Date December 1981

Description County Road (4mi. W of 44 Bar on #93) N.W. of St. Ignatius

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.67	acc/yr	28	x	0.145	=	4.060
Accident Rate	25.69	acc/MEV	100	x	0.199	=	19.900
Accident Severity	13,240	dollars	72	x	0.169	=	12.168
Volume/Capacity Ratio	.061		21	x	0.073	=	1.533
Sight Distance Ratio	0.50	(wt.avg.)	100	x	0.066	=	6.600
Driver Expectancy	3.33	(wt.avg.)	56	x	0.132	=	7.392
Info. System Deficiencies	3.67	(wt.avg.)	61	x	0.102	=	6.222
			SUMS:		0.886*		57.875

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{57.875}{0.886} = 65.322$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 8-1

sea
Stahly
Engineering
&
Associates

1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO ______ BY ______
DATE ______ CK ______
SITE #8

SHORT TERM IMPROVEMENTS

COUNTY ROAD

TRAFFIC COUNT	11-24-81 7:30-8:30 AM
EAST BOUND	6
WEST BOUND	3
SOUTH BOUND	1
	10 TOTAL

MIN. SIGHT DISTANCE 100'
SUPER ELEVATION .1' IN 18'
DEGREE OF CURVE 31.8°

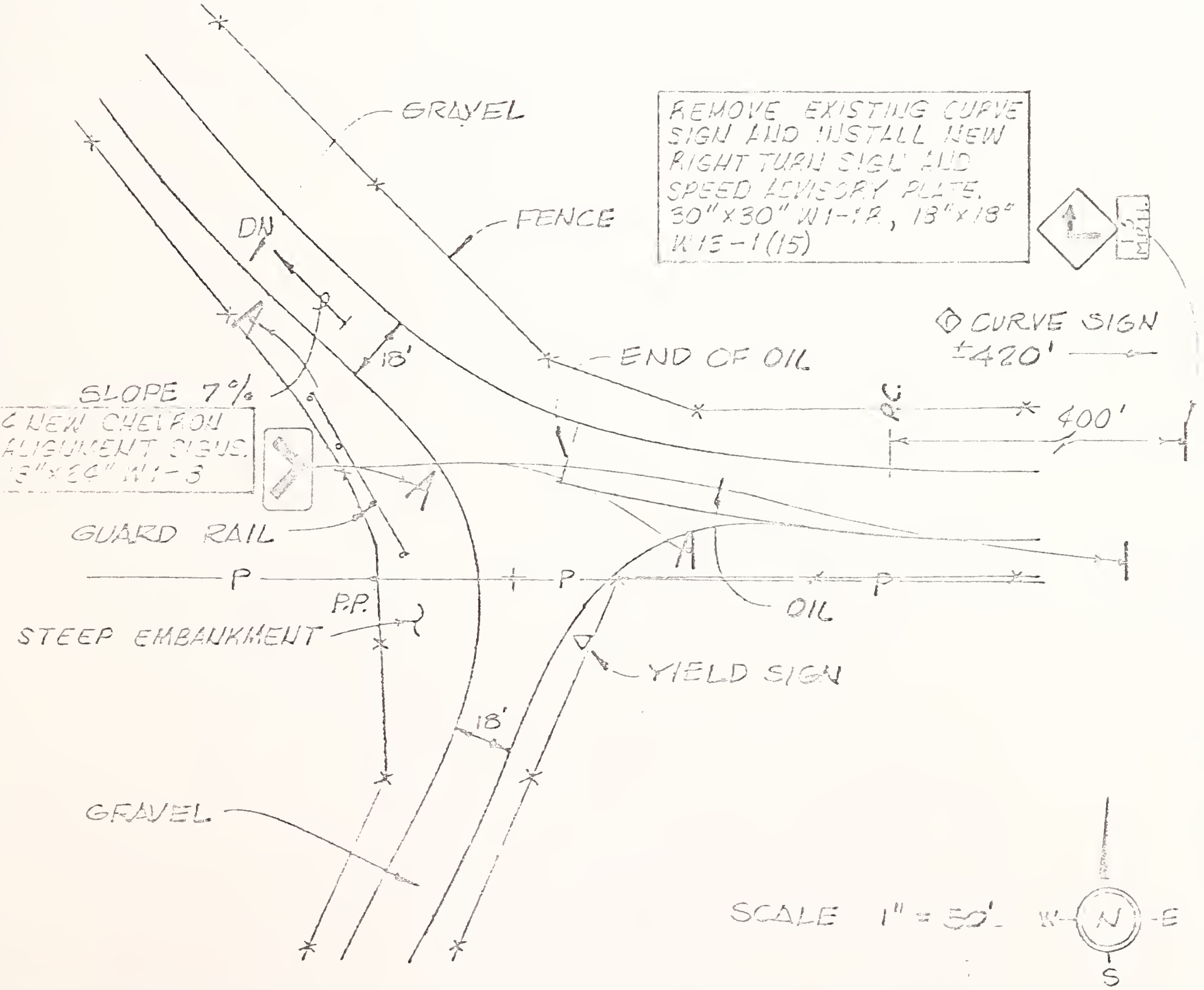

GRAVEL
FENCE
DN
18'
END OF OIL
SLOPE 7%
REMOVE EXISTING CURVE SIGN AND INSTALL NEW RIGHT TURN SIGN AND SPEED ADVISORY PLATE. 30"x30" W1-1R, 18"x18" W13-1(15)
15 M.P.H.
CURVE SIGN
±420'
PC
400'
6 NEW CHEVRON ALIGNMENT SIGNS. 18"x24" W1-8
A
A
A
GUARD RAIL
P
P
P
P.P.
STEEP EMBANKMENT
OIL
YIELD SIGN
18'
GRAVEL
SCALE 1" = 50'
W
N
E
S

Figure 8-3

TABLE 8-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Turn Sign (30" x 30")	1	ea	180.00	180.00
15 mph speed advisory plate (18" x 18")	1	ea	35.00	35.00
Double Chevron Alignment sign with post (18" x 24")	3	ea	180.00	540.00
Single Chevron Alignment Sign with post (18" x 24")	1	ea	130.00	130.00
			TOTAL COST	$ 885.00

SITE 8A

SITE # 8A

COUNTY ROAD N.W. ST. IGNATIUS

LOCATION AND EXISTING CONDITIONS

Site # 8A is located one mile north of site 8, and is five miles north and four miles west of St. Ignatius.

The location is a curve. While traveling to the west, a straight road exists prior to the curve. The degree of curvature of the curve is about 51° with a super elevation of about .05 feet per foot. This relates to a design speed of a little less than 16 mph. There is a downgrade on each side of the curve.

The roadway is 18 feet wide with gravel surfacing. It is an extremely low volume road. The outside of the curve has a steep embankment, which is protected by a short section of guardrail.

Reference is made to Figure 8A-1 which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

During the three year period (1977 to 1979) there were no recorded accidents at this site. However, there was known to be a least one non-recorded accident. This is a much less travel roadway than Site 8, but it has the accident potential of Site 8.

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO ________ BY ________
DATE ________ CK ________
SITE # 8A

EXISTING CONDITION SKETCH

COUNTY ROAD

TRAFFIC COUNT 11-24-81 7:30-8:50 AM
EAST BOUND 2
2 TOTAL

MIN. SIGHT DISTANCE 100'
SUPER ELEVATION .9 IN 18'
DEGREE OF CURVE 50.9°

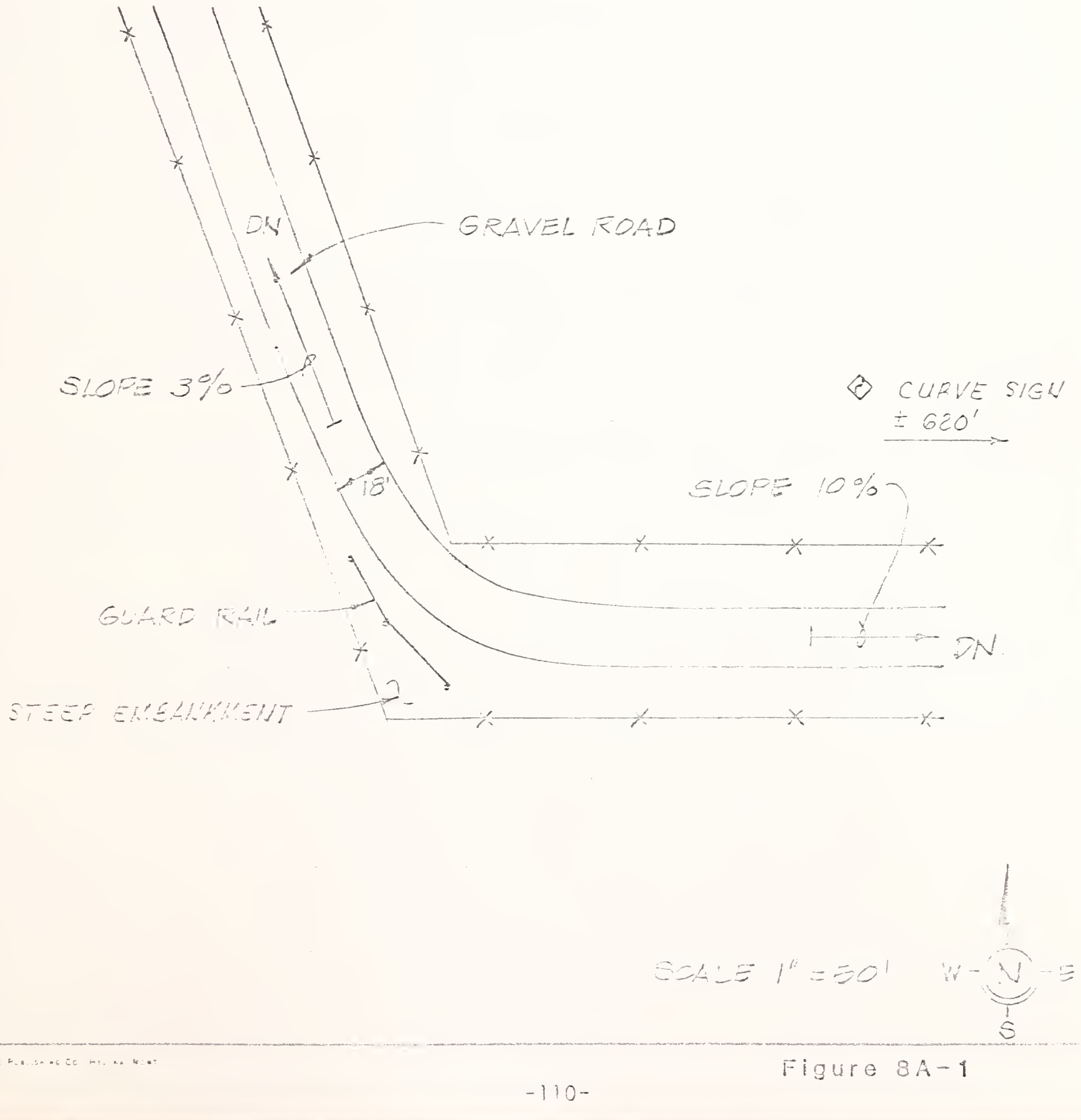


Figure 8A-1

State Publishing Co. Helena, Mont.

TRAFFIC

Peak hour counts were gathered on November 24, 1981 from 7:30 to 8:30 a.m.. The peak hour traffic was factored using a morning factor of 0.056. This resulted in an average daily traffic of 30 ADT.

The capacity of the roadway for level of Service C operation is 110 vehicles per hour. The Volume/Capacity Ratio is:

$$V/C = \frac{30}{24\ (110)} = 0.011$$

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing Sight Distance at this curve is 100 feet. The minimum Safe Stopping Sight Distance is 200 feet at 30 mph. Therefore, the ratio of existing to desirable is 100 divided by 200 = 0.5.

The Driver Expectancy is 2 from the west and 4 from the east giving a weighted average of 3.33. (Highest is weighted twice, next highest, once).

The Informaiton System Deficience is 3 from the west and 4 from the east, giving a weighted average of 3.67.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 8A-1) indicates the indices and analysis parameters derived from the data colleciton efforts.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #8A

Date December 1981

Description County Road N.W. St. Ignatius

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	0	acc/yr	0	x	0.145	=	0
Accident Rate	0	acc/MEV	0	x	0.199	=	0
Accident Severity	0	dollars	0	x	0.169	=	0
Volume/Capacity Ratio	0.11		7	x	0.073	=	0.511
Sight Distance Ratio	0.50	(wt.avg.)	100	x	0.066	=	6.600
Driver Expectancy	3.33	(wt.avg.)	56	x	0.132	=	7.392
Info. System Deficiencies	3.67	(wt.avg.)	61	x	0.102	=	6.222
			SUMS:		0.886*		20.725

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{20.725}{0.886} = 23.392$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE SA-1

SHORT TERM IMPROVEMENTS

The short term improvements to be recommended will provide signing to make the driver more aware of an approaching curve. This is necessary, since prior to the curve, a long section of straight roadway exists.

The recommended improvements are:

1. Install turn signs and 15 mph speed advisory plates.
2. Install 4 chevron alignment signs at the curve.
3. Install Delineators

The recommended improvements are shown on Figure 8A-3.

TABLE 8A-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Turn Sign (30" x 30")	2	ea	180.00	130.00
15 mph speed advisory plate (18" x 18")	2	ea	35.00	70.00
Double Chevron Alignment Sign with post (18" x 24")	3	ea	180.00	540.00
Single Chevron Alignment sign with post (18" x 24")	1	ea	130.00	130.00
Delineators, Design A	18	ea	20.00	360.00
		Total Cost		$1,280.00

STAHLY
ENGINEERING
&
ASSOCIATES

1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

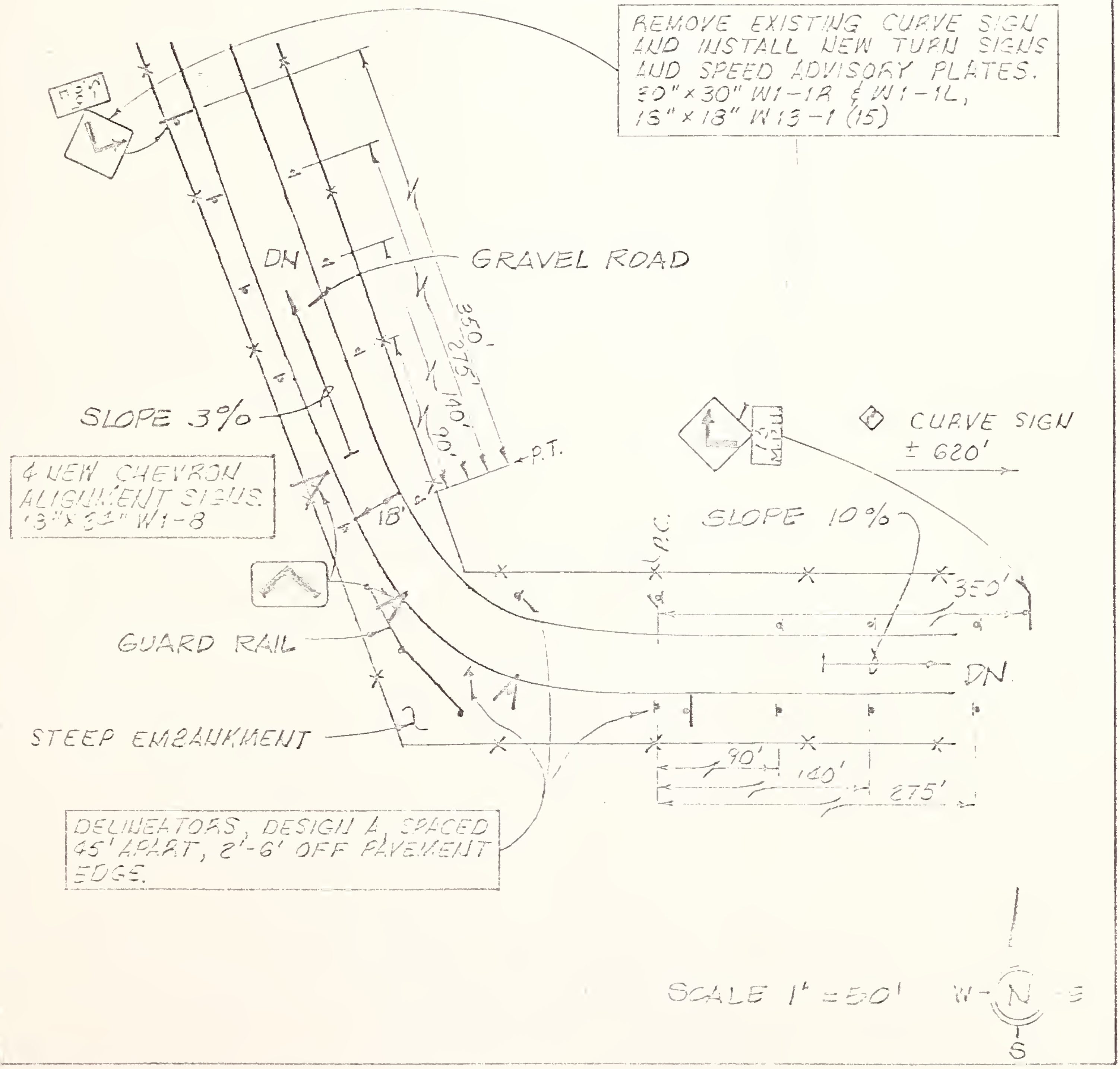
TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ NO ________ BY ________
DATE ________ CK ________
SITE # 8A

SHORT TERM IMPROVEMENTS

COUNTY ROAD

TRAFFIC COUNT 11-24-81 7:30-8:30 AM
EAST BOUND 2
2 TOTAL

MIN. SIGHT DISTANCE 100'
SUPER ELEVATION .9 IN 18'
DEGREE OF CURVE 50.9°



REMOVE EXISTING CURVE SIGN AND INSTALL NEW TURN SIGNS AND SPEED ADVISORY PLATES. 30" × 30" W1-1R & W1-1L, 18" × 18" W13-1 (15)

4 NEW CHEVRON ALIGNMENT SIGNS 18" × 24" W1-8

DELINEATORS, DESIGN A, SPACED 45' APART, 2'-6' OFF PAVEMENT EDGE.

Figure 8A-3

SITE 9

SITE #9

COUNTY ROAD S. E. OF RONAN

LOCATION AND EXISTING CONDITIONS

Site #9 is located southeast of Ronan, in the vicinity of the Clarice Paul Homesite Subdivision. The location is a curve, with a drive serving several homes taking off of the curve. Also, a short distance to the north of the curve, is the exit from the Clarice Paul Homesites.

The road surface was paved a few years ago. The paved width is 24 feet with the curve widened to 30 feet. The degree of curvature of the curve is about 57°, with a super elevation of 0.027 feet per foot. This relates to a design speed of less than 17 mph.

The inside of the curve does have trees growing, which if not maintained, could cause sight distance problems.

Reference is made to Figure 9-1 which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

During the three year period (1977 to 1979), there were two accidents at this location.

The Collision Diagram, Figure 9-2, indicates the types of accidents, and the Accident Summary Sheet, shows different conditions that existed at the time of the accidents.

sea
Stahly Engineering & Associates
1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 122 1st Ave. West
Kalispell, MT 59901

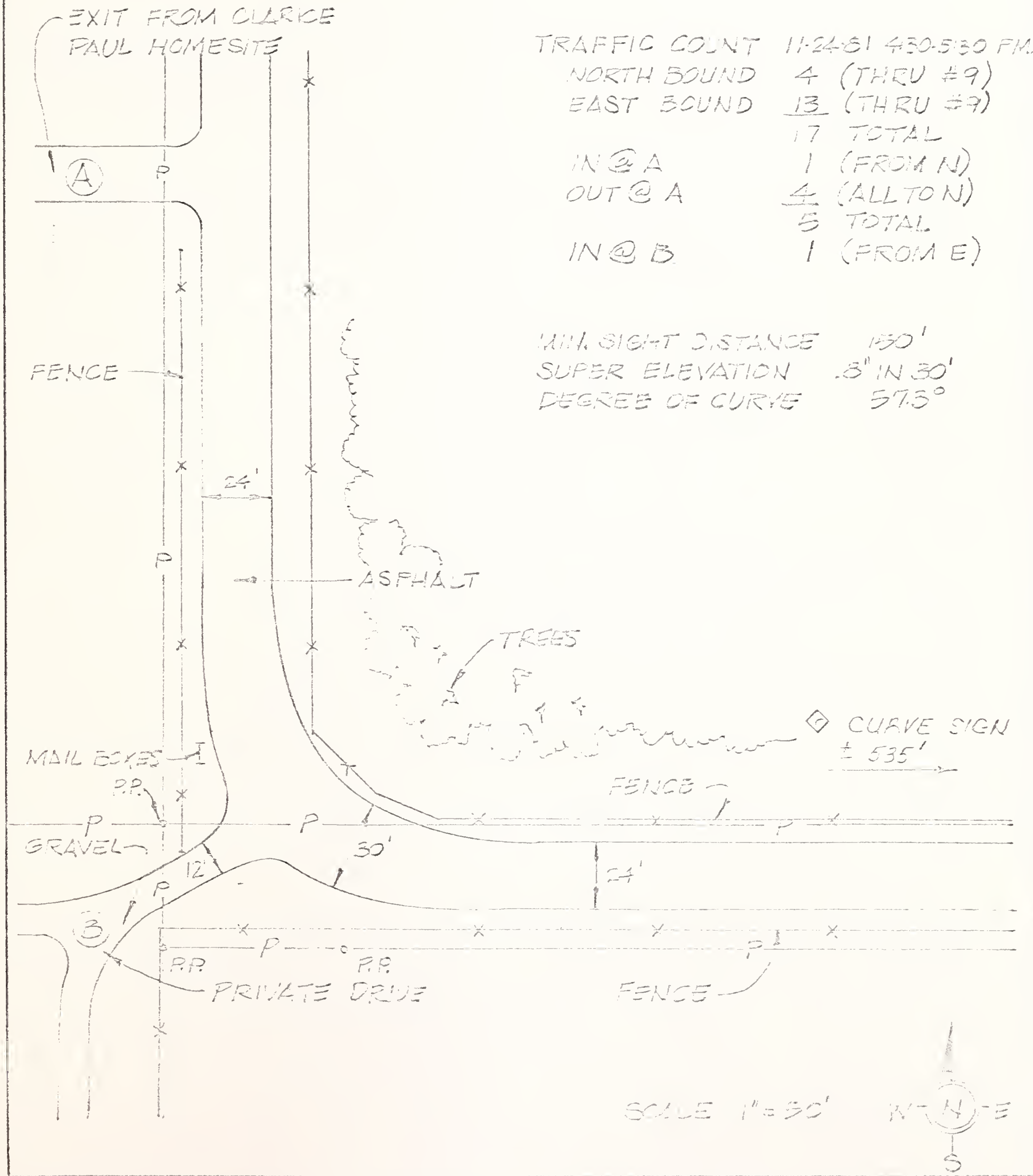
TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO ________ BY ________
DATE ________ CK: ________
SITE # 9

EXISTING CONDITION SKETCH

COUNTY ROAD AT CLARICE PAUL HOMESITES ENTRANCE

TRAFFIC COUNT	11-24-81 430-530 PM.
NORTH BOUND	4 (THRU #9)
EAST BOUND	13 (THRU #9)
	17 TOTAL
IN @ A	1 (FROM N)
OUT @ A	4 (ALL TO N)
	5 TOTAL
IN @ B	1 (FROM E)

MIN. SIGHT DISTANCE	150'
SUPER ELEVATION	.8" IN 30'
DEGREE OF CURVE	57.5°



State Publishing Co. Helena Mont

Figure 9-1

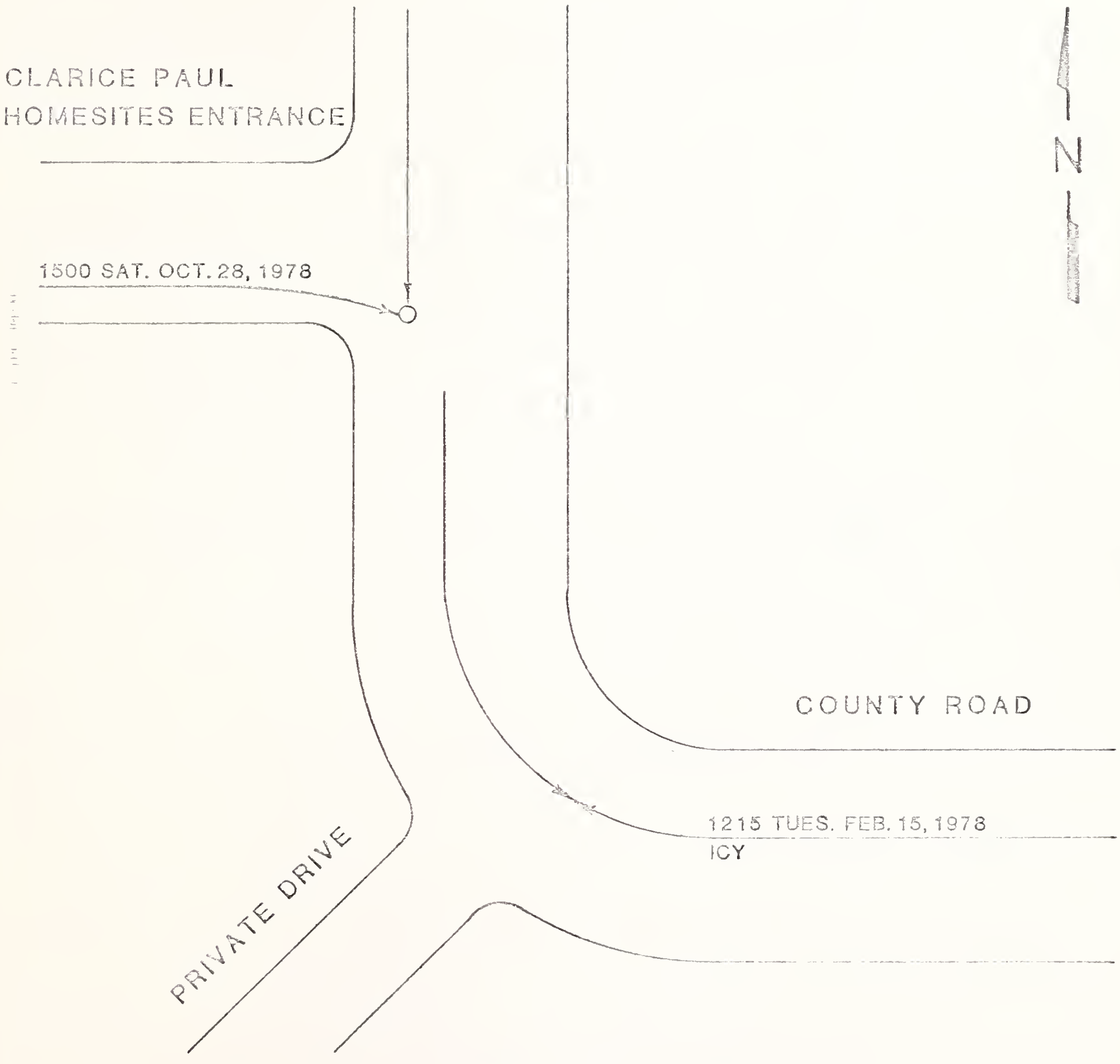
COLLISION DIAGRAM

SITE LOCATION COUNTY ROAD AT CLARICE PAUL HOMESITES ENTRANCE

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 9



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
	← MOVING VEHICLE	←← REAR END	1. TIME, DAY, DATE
1 PROPERTY DAMAGE ONLY	⇇ BACKING VEHICLE	→← HEAD ON	2. WEATHER AND ROAD SURFACE – IF UNUSUAL CONDITION EXISTED
	← – NON-INVOLVED VEHICLE	SIDE SWIPE	3. NIGHT – IF BETWEEN DUSK AND DAWN
1 INJURY OR FATAL	X– – – PEDESTRIAN	OUT OF CONTROL	
	▭ PARKED VEHICLE	LEFT TURN	
	□ FIXED OBJECT	RIGHT ANGLE	
	◉ FATAL ACCIDENT		
2 TOTAL ACCIDENTS	○ INJURY ACCIDENT		

Figure 9-2

The first accident involved two cars on the curve, going in opposite directions. The roadway was icy, and the report stated that the road was also rutted. In addition, the brush on the inside of the curve reduced the sight distance. The second accident involved two cars at the Clarice Paul Homesites exit, located just north of the curve. The driver of the vehicle had his vision reduced because of dust from a passing vehicle. Since this time the road has been paved.

The average accident severity at this site is $9,400.

The average yearly number of accidents is 0.67 accidents per year, with a yearly traffic volume of 0.080 million vehicles.

The accident rate calculates to be 8.38 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981, from 4:30 to 5:30 p.m..

Reference is made to the Graphic Summary, which shows the vehicle movement at the curve. The peak hour traffic was factored using a peak hour evening factor of 0.076, giving an average daily traffic of 220 ADT.

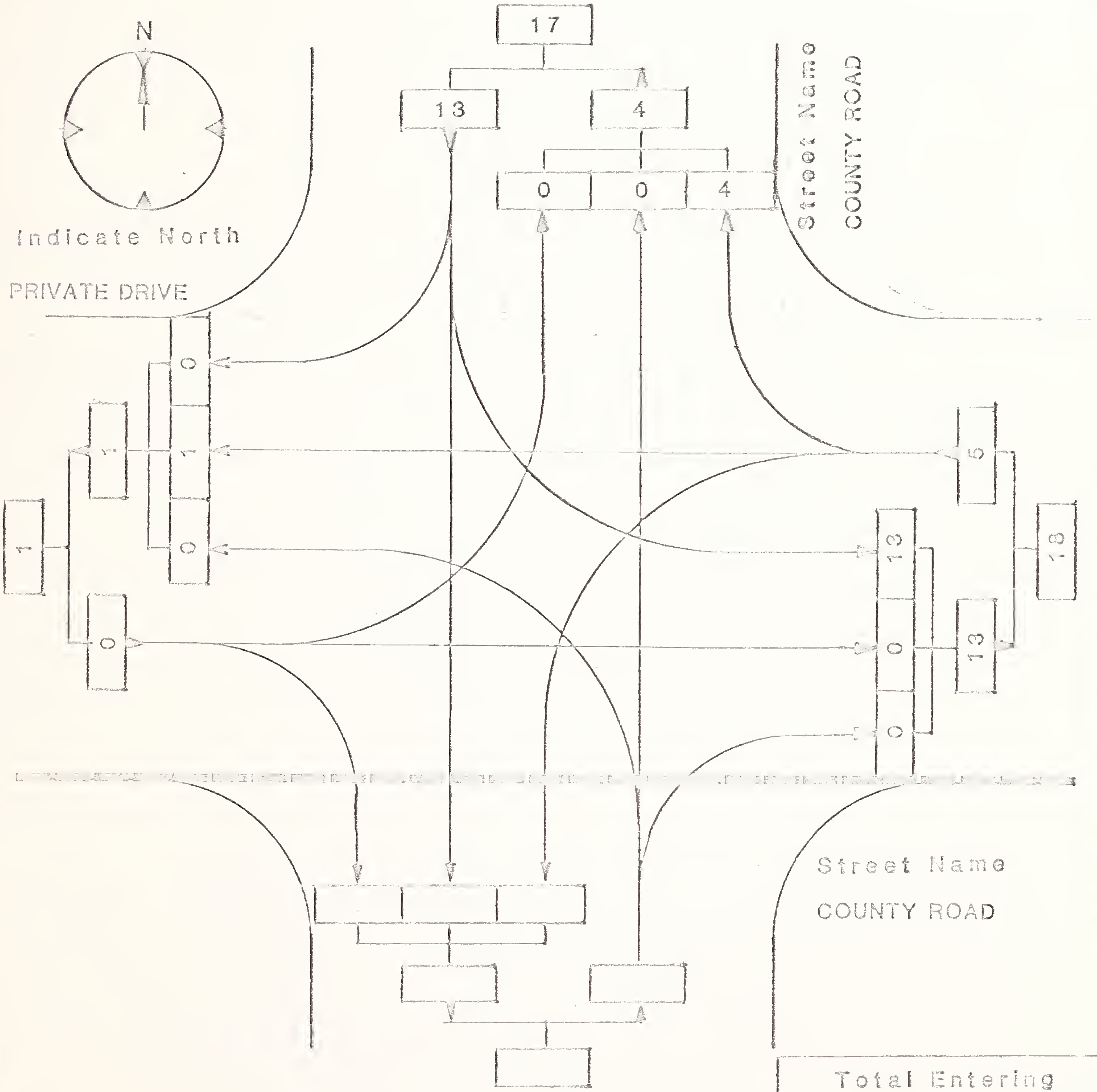
The capacity of the roadway for level of Service C operation is 220 vehicles per hour. The Volume/Capacity Ratio is:

$$V/C = \frac{220}{24\ (220)} = 0.042$$

GRAPHIC SUMMARY OF VEHICLE MOVEMENTS

Intersection of COUNTY ROAD AND
And CLARICE PAUL HOMESITES ENTRANCE
County LAKE
Site 9
Observer

Date NOV. 23, 1981
DAY MONDAY
Time a.m.
p.m. 4:30 TO 5:30



Total Entering		
	a.m.	p.m.
N/S		13
E/W		5
Total		18

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing Sight Distance at this curve is 150 feet. The minimum Safe Stopping Sight Distance is 200 feet at 30 mph. Therefore, the ratio of existing to desirable is 150 divided by 200 = 0.75.

The Driver Expectancy is 2 from the north and 2 from the east, giving a weighted average of 2.

The Information System Deficiency is 4 from both the north and the east, giving a weighted average of 4.

HAZARD INDEX

The Hazard Index Computation Sheet(Table 9-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The short term improvements recommended, will help make the driver more aware of the sharp curve. This is especially necessary since the road has been upgraded with paving, and the speeds become higher.

The recommended improvements are:

1. Install new turn signs with 15 mph advisory speed plates on the approachs.
2. Remove the existing curve sign on the east approach.
3. Install delineators at 45' spacing on each side of the roadway throughout the curve.
4. Keep trees and shrubbery clear on the inside of the curve. (This is presently satisfactory)

The improvements are shown on Figure 9-3.

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #9 Date December 1981

Description County Road S.E. Ronan

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	0.67	acc/yr	12	x	0.145	=	1.740
Accident Rate	8.38	acc/MEV	100	x	0.199	=	19.900
Accident Severity	9400	dollars	62	x	0.169	=	10.478
Volume/Capacity Ratio	.042		17	x	0.073	=	1.241
Sight Distance Ratio	0.75	(wt.avg.)	57	x	0.066	=	3.762
Driver Expectancy	2.00	(wt.avg.)	33	x	0.132	=	4.356
Info. System Deficiencies	4.00	(wt.avg.)	67	x	0.102	=	6.834
			SUMS:		0.886*		48.311

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{48.311}{0.886} = 54.527$$

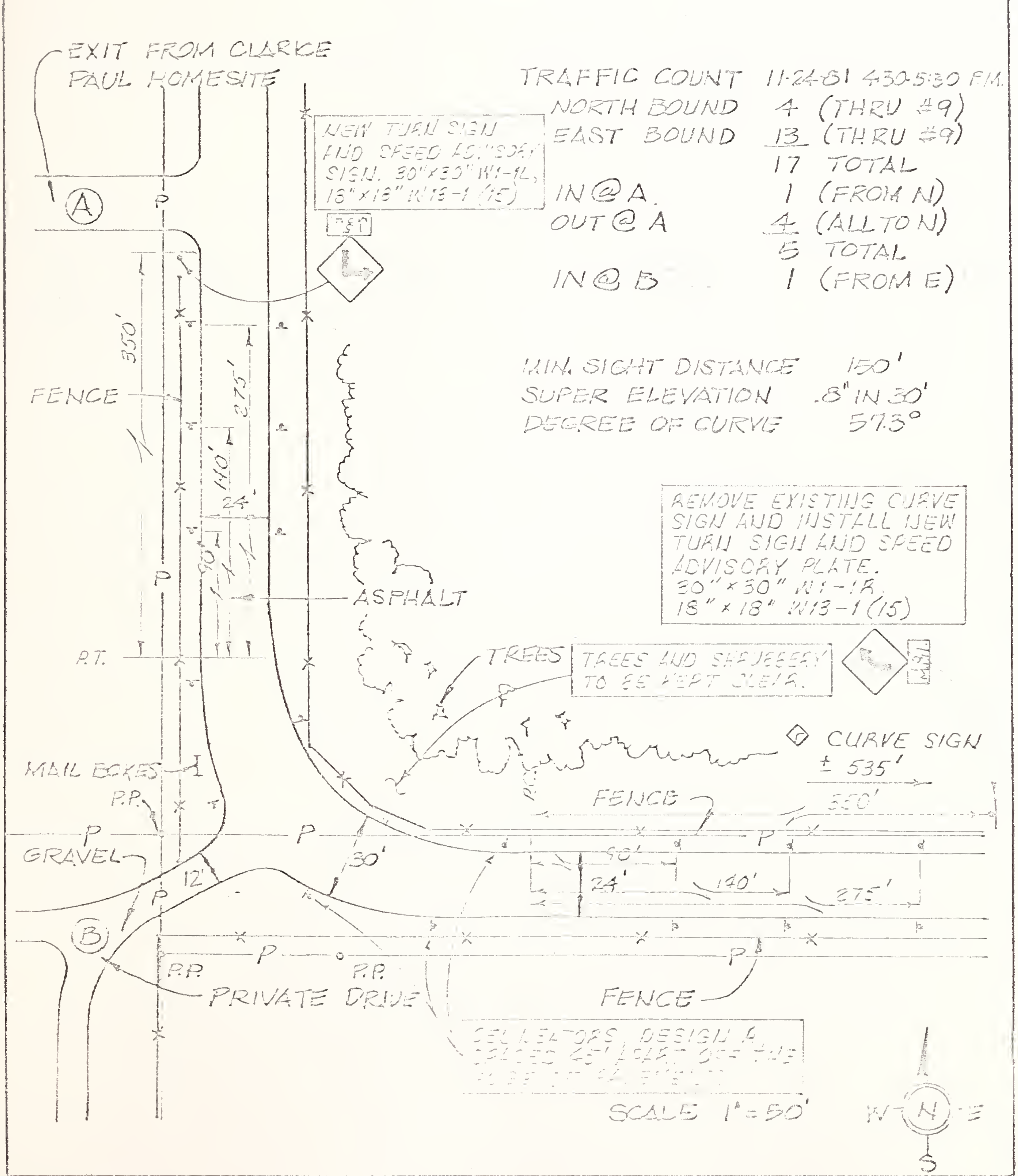
* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 9-1

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO. ____________ BY ____________
DATE ____________ CK ____________
SITE # 9

SHORT TERM IMPROVEMENTS

COUNTY ROAD AT CLARICE PAUL HOMESITES ENTRANCE



TRAFFIC COUNT 11-24-81 4:30-5:30 P.M.
NORTH BOUND 4 (THRU #9)
EAST BOUND 13 (THRU #9)
17 TOTAL
IN @ A 1 (FROM N)
OUT @ A 4 (ALL TO N)
5 TOTAL
IN @ B 1 (FROM E)

MIN. SIGHT DISTANCE 150'
SUPER ELEVATION .8" IN 30'
DEGREE OF CURVE 57.3°

NEW TURN SIGN AND SPEED ADVISORY SIGN. 30"×30" W1-1L, 18"×18" W13-1 (15)

REMOVE EXISTING CURVE SIGN AND INSTALL NEW TURN SIGN AND SPEED ADVISORY PLATE. 30"×30" W1-1R, 18"×18" W13-1 (15)

TREES AND SHRUBBERY TO BE KEPT CLEAR.

DELINEATORS, DESIGN A, SPACED 45' APART OFF THE [illegible]

Figure 9-3

TABLE 9-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
New turn signs with posts (30" x 30")	2	ea	180.00	360.00
New speed advisory plates (18' x 18")	2	ea	35.00	70.00
Delineators	18	ea	20.00	360.00
			Total Cost	$ 790.00

SITE 10

SITE # 10

FAS 530 COUNTY ROAD EAST OF RONAN

LOCATION AND EXISTING CONDITIONS

Site #10 is located about $1\frac{1}{2}$ miles east of Ronan. The location is the east-west county road from the intersection of Cemetary Raod to about 0.9 miles to the east.

The road surface is paved to a width of 22 feet. The road presently has gravel shoulders, which would make it possible to provide a wider paved roadway. The roadway is straight, with numerous private drive entrances on each side. In this section of the road, there are 21 private drives on the north side and 12 private drives on the south side. The road has a posted speed limit of 35 mph.

Reference is made to Figure 10-1, which is the Existing Condition Sketch.

ACCIDENT ANALYSIS

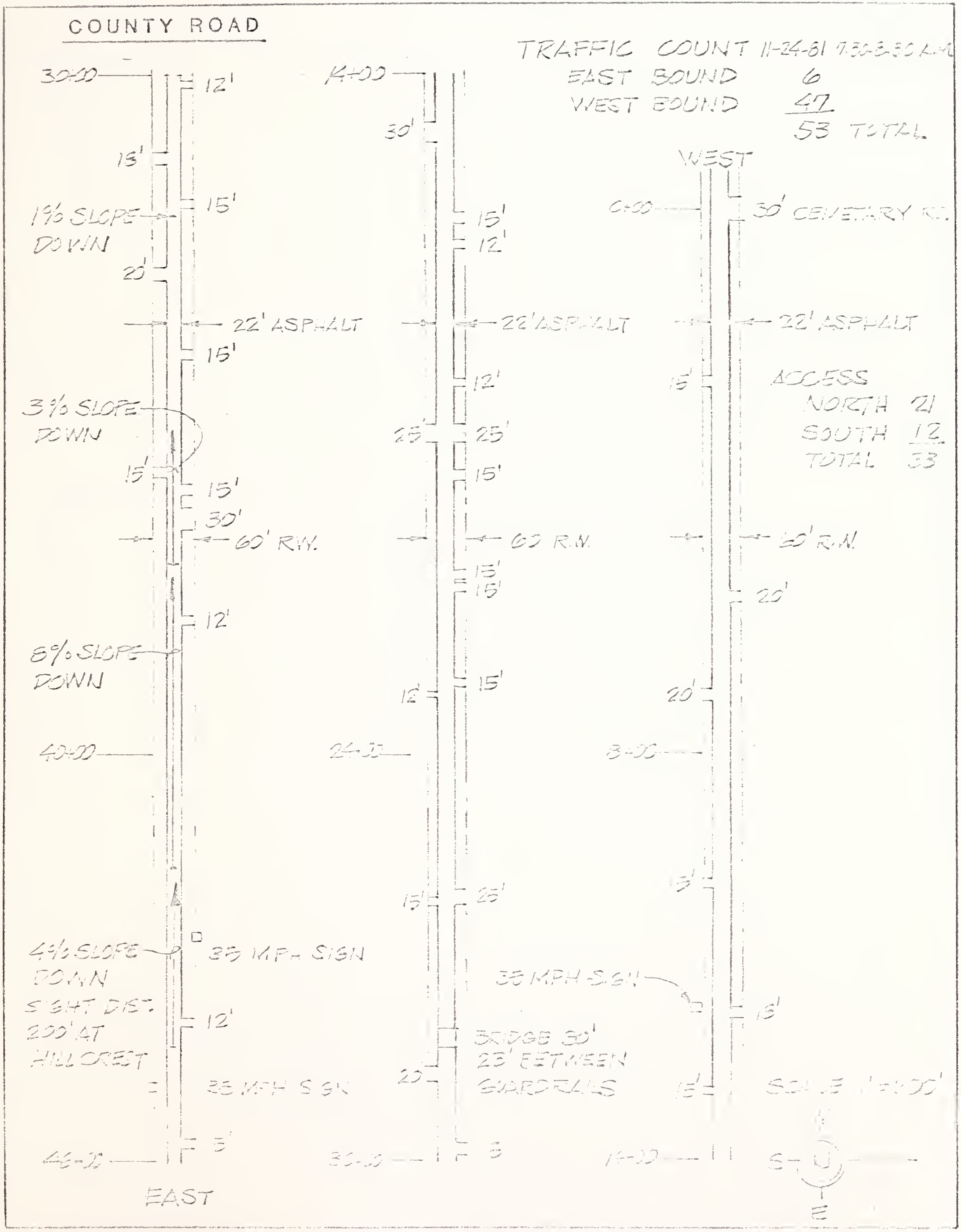
During the three year period, (1977 to 1979), there were three accidents on this section of roadway. Reference is made to the Collison Diagram, Figure 10-2, and the following Accident Summary Sheet, for futher details on the accidents.

Two accidents invovled single vehicles leaving the roadway. One involved alcohol and speed too fast for road conditions. The other involved an icy roadway.

The other accident involved a vehicle passing another while attempting a left turn into a private driveway.

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO ______ BY ______
DATE ______ CK: ______
SITE #10

EXISTING CONDITION SKETCH


COUNTY ROAD

TRAFFIC COUNT 11-24-81 7:30-8:30 A.M.
EAST BOUND 6
WEST BOUND 47
53 TOTAL

ACCESS
NORTH 21
SOUTH 12
TOTAL 33

SCALE 1"=200'

Figure 10-1

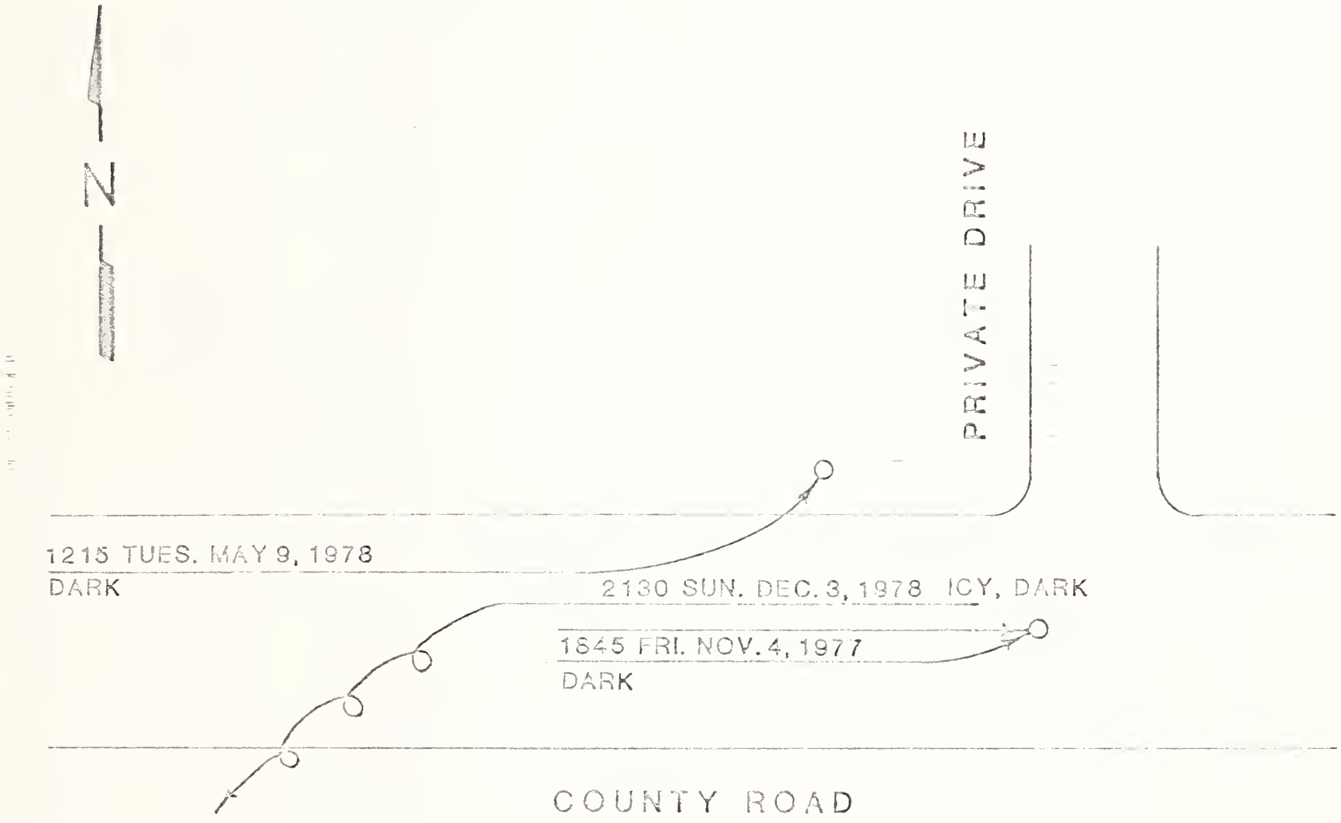
COLLISION DIAGRAM

SITE LOCATION COUNTY ROAD

PERIOD 3 YEARS FROM JAN. 1, 1977 TO DEC. 31, 1979

PREPARED BY STAHLY ENGINEERING & ASSOC.

SITE NO. 10



NUMBER OF ACCIDENTS	SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
1 PROPERTY DAMAGE ONLY 2 INJURY OR FATAL 3 TOTAL ACCIDENTS	MOVING VEHICLE BACKING VEHICLE NON-INVOLVED VEHICLE PEDESTRIAN PARKED VEHICLE □ FIXED OBJECT ● FATAL ACCIDENT ○ INJURY ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	1. TIME, DAY, DATE 2. WEATHER AND ROAD SURFACE - IF UNUSUAL CONDITION EXISTED 3. NIGHT - IF BETWEEN DUSK AND DAWN

Figure 10-2

ACCIDENT SUMMARY

SITE NUMBER 10 LOCATION COUNTY ROAD REPORTING PERIOD 1977-1979

MONTH	NO.	DAY OF WK.	NO.	WEATHER	NO.	ROAD CONDITION	NO.	LIGHT COND	NO.	ACCID TYPE	NO.	YEAR & SEVERITY	NO.
JAN.		SUN.		CLEAR	3	DRY	2	Day		ANGLE		1977 FATAL	
FEB.		MON.	1	RAIN		WET		DAWN OR DUSK		LEFT TURN	1	INJURY	1
MARCH		TUE.	1	SNOW		SNOWY		DARK LIGHTED		REAR END		PROPERTY. DAMAGE ONLY	
APRIL		WED.		FOG		ICY	1	DARK UN LIGHTED	3	HEAD ON		1978 FATAL	
MAY	1	THURS.		OTHER		OTHER				SIDE SWIPE		INJURY	1
JUNE		FRI.	1							PARKED VEHICLE		PROPERTY DAMAGE ONLY	1
JULY		SAT.								BACKING		FATAL	
AUGUST										FIXED OBJECT	1	INJURY	
SEPT.										NON COLLIS	1	PROPERTY DAMAGE ONLY	
OCT.										ANIMAL			
NOV.	1												
DEC.	1												

The average accident severity at this location is $8,467.

The average yearly number of accidents is 1.00 accidents per year, with a yearly traffic volume of 0.345 million vehicles.

The accident rate calculates to be 2.90 accidents per million entering vehicles (MEV).

TRAFFIC

Peak hour traffic counts were gathered on November 24, 1981 from 7:30 to 8:30 a.m.. The peak hour count was factored using a peak hour morning factor of 0.056. The average daily traffic computes to be 946 ADT.

The capacity of the roadway for level of Service C operation is 312 vehicles per hour. The Volume/Capacity Ratio is:

$$V/C = \frac{946}{24\ (312)} = 0.126$$

SIGHT DISTANCE, DRIVER EXPECTANCY, AND INFORMATION SYSTEM DEFICIENCIES

The existing Sight Distance at the crest of the hill at the east end of this section is 200 feet. The minimum Safe Stopping Sight Distance is 275 feet at 35 mph, the posted speed limit. Therefore, the ratio of existing to desirable is 200 divided by 275 = 0.73.

The Driver Expectancy is 2 from both directions.

The Information System Deficiency is 3 from both directions.

HAZARD INDEX

The Hazard Index Computation Sheet (Table 10-1) indicates the indices and analysis parameters derived from the data collection efforts.

SHORT TERM IMPROVEMENTS

The roadway presently has a 35 mph posted speed limit. It has also been recently widened. It could be suggested that stronger enforcement of the speed limit, might help reduce the accidents. Several of the accidents involved excessive speed.

The recommended improvement is to install delineators along each side of the roadway for the entire section.

The improvements are shown on Figure 10-3.

TABLE 10-2

COST ESTIMATE

SHORT TERM IMPROVEMENTS

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
Delineators	48	ea	$20.00	$960.00
			Total Cost	$960.00

HAZARD INDEX

BASIC COMPUTATIONS

Site Number #10 Date December 1981

Description FAS 530 County Road East of Ronan

Indicator	Data Value		Indicator Value		Weight		Partial H.I.'s
Number of Accidents	1.00	acc/yr	21	x	0.145	=	3.045
Accident Rate	2.90	acc/MEV	55	x	0.199	=	10.945
Accident Severity	8,467	dollars	59	x	0.169	=	9.971
Volume/Capacity Ratio	.126		31	x	0.073	=	2.263
Sight Distance Ratio	0.73	(wt.avg.)	61	x	0.066	=	4.026
Driver Expectancy	2.00	(wt.avg.)	33	x	0.132	=	4.356
Info. System Deficiencies	3.00	(wt.avg.)	50	x	0.102	=	5.100
			SUMS:		0.886*		39.706

$$\text{H.I.} = \frac{\text{Sum of Partial H.I.'s}}{\text{Sum of Applicable Weights}} = \frac{39.706}{0.886} = 44.815$$

* The "Erratic Maneuvers" and "Traffic Conflicts" indices were omitted from this study. Therefore the weight factors do not total 1.00 and all sites will be ranked on an 88.6% strength of evaluation relative to the FHWA Method.

TABLE 10-1

Stahly
Engineering
&
Associates

1 SOUTH DAKOTA • HELENA, MONTANA 59601
BRANCH OFFICE: 30 Fifth Street E., Suite 104
Kalispell, MT 59901

TITLE LAKE CO. TRAFFIC HAZARD STUDY
PROJ. NO ______ BY ______
DATE ______ CK: ______

SITE #10

SHORT TERM IMPROVEMENTS.

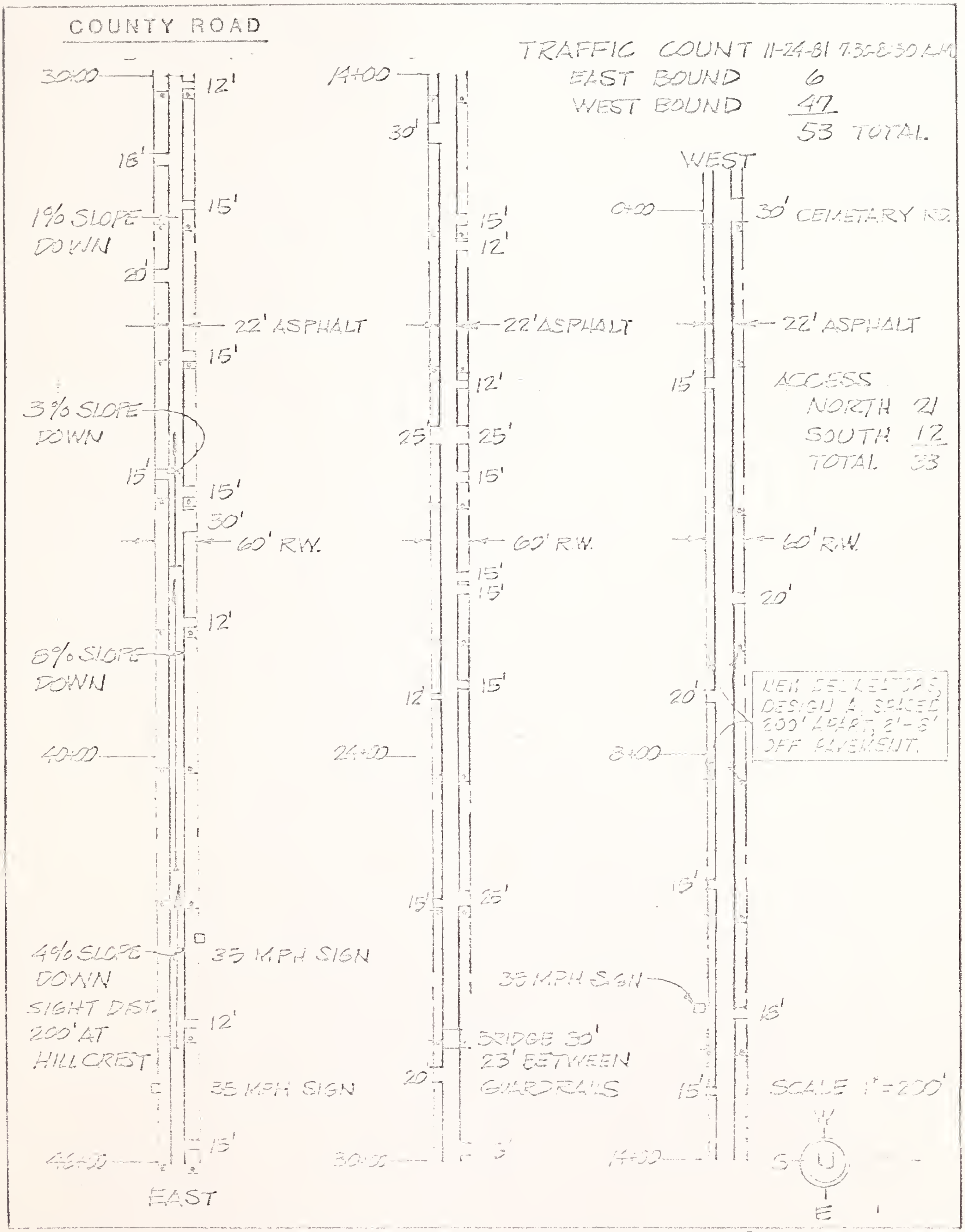


Figure 10-3